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THE HANDYMAN'S ENQUIRE WITHIN

MAKING, MENDING, RENOVATING

EDITED BY

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PREFACE

The Handyman's Enquire Within does for the handy[illegible] at a well-known and popular volume has done for the housewife. Whe[illegible] fficulty about any little job in the house, he has only to enquire within its pages to find just the information he needs. The sub-title, "Making, Mending, Renovating," throws some light on the contents of the book, but by no means fully covers its scope. It would be a heavy task to describe the entire contents, and nothing short of repeating the thousands of paragraph headings would serve this purpose. But it is not too great a claim that almost every job the household handyman is ever called upon to do is described in this work. The arrangement is alphabetical, with cross references where necessary, so disclosing at a glance the information contained. In attempting to give an idea of the scope and contents of the book, perhaps the best course is to mention a few subjects taken casually as the pages are turned over: Acetylene, how to prepare it, and how to clean and manage acetylene lamps; acids, how they are made and used; aluminium, how to clean it, solder it, etc.; making and repairing bamboo furniture; barometer cleaning, adjusting, and repairing; simple bookbinding; putting up clothes-poles; cricket-bat repairing; cycle adjustment and tyre repairs; the fixing of electric alarms and bells, and the making of batteries; fountain-pen repairs; preparing and using glue; putting on a hinge; repairing a lock and fitting a key; hanging pictures and putting up picture rods and rails; sharpening and setting a razor; using a saw; putting up a shelf; fixing tiles; umbrella repairing; cleaning and repairing a wringing machine. All these and thousands of other jobs of which the above are typical are explained in the "Handyman's Enquire Within"; and in every instance the information supplied is plainly worded and thoroughly practical.

The illustrations number several hundred, and will be found to be extremely clear.

P. N. HASLUCK.

La Belle Sauvage, London, E.C.,
April, 1908.

LIST OF COLOURED PLATES

HANDYMAN'S ENQUIRE WITHIN

Acetylene

ACETYLENE gas is produced commercially from calcic carbide (commonly called carbide of calcium). For this a mixture of, say, 100 parts by weight of lime and 68 parts of powdered carbon (generally coke) is used. This mixture is subjected to the intense heat of an electric furnace, and carbide of calcium is formed, consisting of 40 parts by weight of calcium to 24 of carbon. Calcic carbide is dark greyish, highly crystalline, and semi-metallic, with a specific gravity of 2·26. On contact with water it at once produces a rapid effervescence, the hydrogen of the water uniting with the carbon of the carbide to form acetylene, which escapes, while the oxygen of the water combines with calcium to form quicklime, which, in the presence of excess of moisture, is rapidly converted into hydrate of calcium or slaked lime. Calcic carbide cannot be kept exposed to the moisture of the air, as its surface rapidly deteriorates, small quantities of acetylene being given off. It must therefore be packed in air-tight and water-tight drums. Acetylene burns with a luminous and very smoky flame, but acetylene being mixed with air in equal volumes the mixture burns with a dullish red flame, giving off smoke, and leaving behind a residue of soot. In the proportion of 1 volume of acetylene to 1·25 volumes of air the mixture is slightly explosive, and its explosiveness increases with the addition of air until with twelve times its volume of air it reaches its maximum intensity. A mixture of 1 volume of acetylene with 20 volumes of air is non-explosive. Acetylene is soluble in water. At ordinary temperature and pressure 10 volumes of water will absorb 11 volumes of the gas, but, unless the gas be bubbled through the water, the absorption is hardly noticeable in an ordinary gas holder or receiver. Acetylene is highly soluble in some other fluids, notably acetone; when so dissolved under pressure and contained in steel cylinders it makes possible a very convenient form of supply. When water and calcic carbide mutually react upon each other great heat is developed, and, if the carbide be in excess, the temperature will often rise to a dangerous extent, forming hydrocarbons of a condensable character, and sometimes causing the gas to decompose with explosive violence; also the gas will be very impure. This happens when water is allowed to drop upon the carbide, and generators made on this principle must be provided with an arrangement for keeping down the heat. The most suitable generating apparatus allows the calcium carbide to drop into a large volume of water, so that the gas bubbles through sufficient water properly to condense and wash it. Another important point in a generator is that under no conditions should the pressure rise above a few inches of water, while the pressure in the pipes leaving the apparatus must never be above 2 in. or 3 in. of water. One pound of calcic carbide generates nearly 5 cub. ft. of gas. The illuminating power of acetylene is generally stated as 240 candles per 5 cub. ft., but 175 candles more nearly represents the actual value. Acetylene ignites at a temperature of 896° F., which is lower than the temperature of ignition of any other gas, and decomposes at about 1,300° F. with

deposition of carbon. When burnt in air, it produces a maximum temperature of 4,388° F., which is higher than that yielded by any other combustible gas. The high tempera-

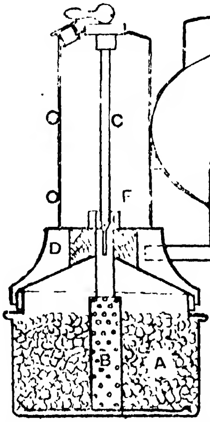

Fig. 1.—Section of Acetylene Lamp in which Water Drops on Carbide.

ture of combustion and the large quantity of carbon which is separated out account for its high illuminating power. When acetylene burns, a portion of the carbon in the interior of the flame does not obtain sufficient air for its perfect combustion, unless special burners are used, with the result that the flame becomes smoky.

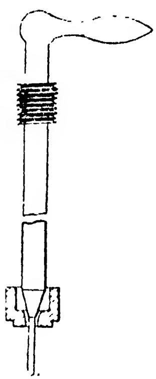

Fig. 2.—Water Supply Valve of Acetylene Lamp.

Acetylene Cycle Lamps.—In acetylene cycle lamps of good make an explosion is practically impossible, whilst their management presents no special obstacles. These lamps are either self-contained, the generator and burner being combined in the one apparatus, or the generator is separate from the lamp, being clipped on the frame and connected to the burner on the lamp bracket by a rubber tube. The majority are self-contained. The contact between the water and the carbide is brought about in three ways: (1) water is allowed to fall drop by drop on to the carbide; (2) the water rises from below to the carbide; and (3) the water is syphoned on to the carbide by means of a wick or some such capillary material. The first class is the one most used, and Fig. 1 represents the general principle. The carbide

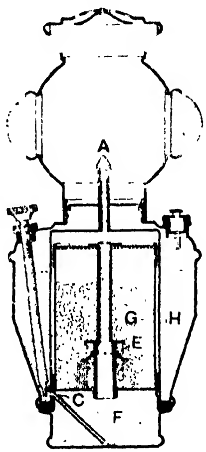

Fig. 3.—Section of Acetylene Lamp in which Water Rises to Carbide.

is placed in a cup A, fitting in an outer casing, which can be screwed or clamped on the body of the lamp, the joint being made gas-tight by a rubber ring or washer. The cup is provided with a central vertical perforated tube B, down which the water drops, and which serves to diffuse the water evenly to the surrounding carbide. The upper part of the lamp C forms the water chamber, whilst between it and the carbide vessel is a space D, which is filled with a material like cotton-wool, by which the gas is filtered from any suspended lime-dust, etc., before passing to the burner E. The supply of water can be regulated by means of the valve F, shown enlarged in Fig. 2. This valve consists of a rod, turned at one end to

a cone that fits water-tight on a seating. The rod is threaded to screw in a boss on the water reservoir. The outer end has a milled head, or other finger grip, by turning which the valve can be opened or closed, and the rate of flow of the water regulated as

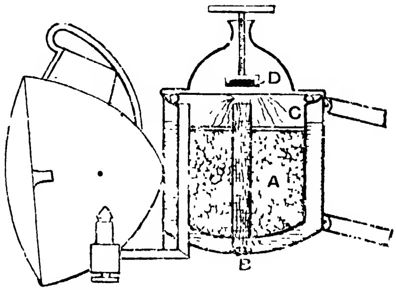

Fig. 4.—Section of Acetylene Lamp in which Water is Syphoned to Carbide.

required. The gas passes through the filter chamber D to the burner E, which is placed in the focus of a reflector in the burner chamber. The second class, in which water rises to the carbide, is illustrated in Fig. 3. The carbide is placed in a chamber G surrounded by water in the outer vessel H. The water is allowed to act on the carbide when required by opening the valve C as far as it will go, as the water supply does not require regulating. The water then fills the lower chamber F, which acts as a small store for any surplus gas, and rises to the carbide through the perforated tube E, the linen casing of which causes an even distribution of the water to the carbide. The evolved gas is led by a tube from the carbide vessel to the burner A at the top of the lamp, the burner chamber fitting on by means of a bayonet joint. This lamp is automatic, excess of gas driving the water from the carbide until the pressure has been removed by consumption; but the light varies greatly, the flame increasing as the result of increase in pressure, and gradually decreasing as the water rises and attacks the carbide once more. In the third class (Fig. 4) the carbide is placed in the water-jacketed vessel A, up the centre of which is a tube B, the upper end of which projects a short distance above the level of the water chamber. A tassel of loose strands of wick is passed down the tube to the bottom, and the free ends are spread over a disc C of copper gauze lying on the surface of the carbide. The wick gradually syphons the water on to the carbide, but the chief objection to its use is that before long the fibres become choked with lime, and lose their capillary properties. A screw stopper D, fitted with a rubber plug, serves to prevent the water splashing on the carbide before the lamp is required for use.

Acetylene Cycle Lamp Burners.—The burners employed in acetylene cycle lamps comprise the straight jet and the flat flame; steatite or some such non-conductor of heat is employed, although metal burners have been used, but they should be avoided. The straight jet flame (Fig. 5) is usually found in lamps of English make. It causes very little trouble, but does not produce quite as much light as the flat flame. Fig. 6 shows the straight jet burner in section. As the gas issues from the fine outlet at A it draws air through the lateral openings B, so that at the apex of the burner the base of the flame is surrounded by an outer envelope of air, which serves to keep it from contact with the burner, and thus, to a large extent, prevents carbonising—that is, the formation on the burner of a hard crust of carbon, which causes distortion of the flame. The

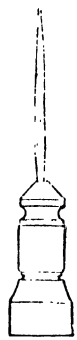

Fig. 5. Acetylene Burner giving Straight Jet Flame.

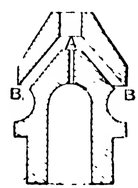

Fig. 6.—Section of Acetylene Burner giving Straight Jet Flame.

flat-flame burner generally used is shown by Figs. 7 and 8. The principle is the same as that employed in the ordinary union jet burner used for coal gas, but the holes are much smaller, and are inclined at a greater

angle. Two holes are generally drilled through the steatite head, entirely separate from the gas holes, so as to direct a stream of air against the burner orifice in order to consume any carbonaceous deposit that may be formed. The burner that seems most

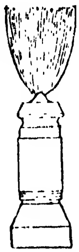

Fig. 7.—Acetylene Burner giving Flat Flame.

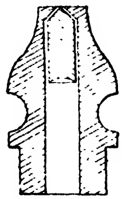

Fig. 8. Section of Acetylene Burner giving Flat Flame.

suitable has two jets of gas, each surrounded by its tube of air, and impinging upon one another at an angle, the jets being thus splayed out to form a flat flame. Such a burner (see Figs. 9 and 10) should be constructed entirely of steatite; for if metal be used to carry the injector tips, the arms are apt to warp owing to the heat, and thus to produce a distorted flame.

Acetylene Cycle Lamps: Choosing.—The main points to be observed in choosing a lamp are as follows:—The water should be supplied to the carbide centrally; if the carbide vessel screws on to the lamp, the thread should be a coarse one, and the carbide should be prevented from shaking by a spring plate or similar contrivance. Provision should be made for filtering the gas, chemical purification not being necessary. There should be some arrangement for cleaning the burner; this process is usually accomplished by inserting a fine wire in the small gas hole, or by attaching a cycle pump to a threaded connection below the burner, whereby a blast of air can be forced through. As the lamps are heavier than the average oil lamp, the spring-back should be strong. It is a convenience to have a scale fitted to the water-regulating valve head, so that the correct position of the valve having been once noted can be again found quickly.

Acetylene Cycle Lamps: Management.—A few words are necessary as regards management. The lamp should be taken to pieces so that a thorough knowledge of the relationship of the various parts may be obtained. The carbide chamber having been removed, the water reservoir should be filled with clean water, and the rate of flow noted when the indicator on the valve head is at various points on the scale. Generally, about fifteen to twenty drops of water per minute should be allowed to pass, but this varies with the lamp. When the lamp is travelling, the vibration causes a slight increase in the supply, which should be allowed for. The water can next be turned off, and the carbide vessel charged. Good carbide, guaranteed to give 5 cub. ft. of gas per lb., should be the only quality employed, and should be broken up to pieces of about the size of small hazel nuts or a little less. If larger pieces are put in, water may collect between the lumps and cause a disconcerting rush of gas. Care should be taken that no pieces fall into the central tube, and the best way to avoid this is to place the finger over the perforated tube whilst charging. Remember that, as the lime residue occupies a larger space than the original carbide, the charge must only fill about three-quarters of the total capacity of the carbide cup. The carbide vessel may be attached to the lamp, the junction being clamped or screwed up tight; and when the

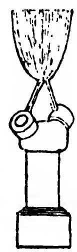

Fig. 9.—Acetylene Burner giving Splayed Flat Flame.

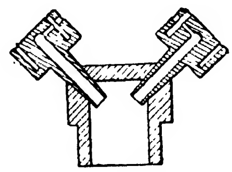

Fig. 10.—Section of Acetylene Burner giving Splayed Flat Flame.

water is turned on to the position before noted, gas will be generated, and in about a minute a light can be applied to the burner. The size of the flame will give a clue as to the position of the water valve; with a straight-jet burner, the flame should be about 1 in. high, while a flat flame should be

of a good white colour, burning quietly. Owing to the vibration on the machine, the valve should be turned back a trifle, and its position can be noted for future reference. As the charge of carbide gets exhausted, the flow of water may be increased, but when the lamp is being started the water must not be in excess, or the burner will flare, and the surplus gas, forcing its way through the water valve, will escape, causing the lamp to smell abominably. Moreover, the filtering material soon gets water-logged from condensed steam, and drops of water form in the burner tube, effectually cutting off the gas supply, and the light goes out. When the charge of carbide is exhausted, the lamp must be taken to pieces, the residue thrown away, and the various portions dried. The lamp should not be left uncleaned after use as, in a few days, the lime sets into a hard mass which is difficult to remove. A little French chalk should be dusted on the rubber ring of the carbide vessel to prevent it sticking when the lamp is not in use; and when charging the lamp, any particles of carbide should be removed from the rubber ring. Should the burner get choked, it must be cleaned by passing a very fine steel wire down through its holes; a blast of air from a cycle pump will then clear away any dust. Burners often carbonise as the flame dies down, owing to the exhaustion of the charge or the cutting off of the water supply; for this there is no remedy, save blowing out the flame and letting the remainder of the gas pass away unburnt, of course outside the house. The filtering material should be renewed from time to time. The length of time the light will last depends on the quality of the carbide, the size of the burner, and the rate at which the water is supplied. The average burner will pass about ¼ cub. ft. per hour, and the best carbide may be depended upon to give in these lamps 4½ cub. ft. of gas per lb.; so that with a charge of 4 oz. of carbide and a careful regulation of the water supply, a light for four and a half hours can be obtained. Sometimes the whole of a charge is not used in one ride; the lamp can be used again for a short time within a day or two, but the amount of unexhausted carbide is a matter of uncertainty, as the water in the portion already used gradually attacks the unused material. The best plan is to use enough carbide to last out the ride. If the lamp is required for a longer period than four and a half hours, a spare charge of carbide can be carried in the pocket in a small air-tight tin. In time of frost, the water may freeze in its reservoir when the lamp is not lit. This can be obviated to some extent by adding a little methylated spirit to the water, or by using a strong solution of brine; but in the second case, after use, the remainder must be emptied out and the water chamber washed with clean water in order to avoid corrosion of the metal.

Acetylene Cycle and Motor-car Lamps: Overhauling.—Acetylene lamps that have been laid aside during the summer months should be taken to pieces, says "The Motor." The burners should be carefully cleared with a pricker, or with a piece of finest brass wire, and then have a good scavenging from the tyre pump. A burner that has badly choked once may soon get choked again, and the best course is to replace it by a new one. Bray's "Elta" burner has the advantage that, whether the jet is turned high or low, or varies in size from any other cause, it is always quite free from carbon deposits. The filter pads should next receive attention. Most lamps have a pad of felt or cotton-wool, through which the gas passes on its way to the burner, the pad arresting the dust particles which otherwise would clog the apertures. In course of time the filtering material becomes moist, and should then be renewed. The tyre pump may be applied to all tubes and passages, either for gas or water. Rubber tubing and connections will very likely have been perished by the action of the acetylene, and should be renewed; this also applies to the rubber washer, which in many lamps constitutes the joint of the carbide chamber. Where separate generators are employed, and the connection between these and the lamps has been maintained by copper tubing, this also will probably be found to be eaten through, or nearly so, in places, and should be replaced by brass or composition tubing, which is unaffected by the gas. All taps should be treated with castor oil to prevent them from getting stiff and leaky. The

outsides of the generators should be scraped and brushed free from all traces of lime deposit. If kept clean and regularly attended to after each time of use, acetylene lamps will rarely give trouble on the road.

Acids

The following paragraphs relate to acids, acid-proof cements, etc., which are likely to be used by the handyman.

Acid Bottle Stoppers, Paste for.—For bottles containing acid, the luting material is generally plaster-of-Paris, made into a paste with water; for other bottles, almond meal is used. The latter is a waste product from which the almond essence and oil have been extracted. The best acid-proof luting for rubber stoppers is made as follows:—Reduce ½ oz. of best flake shellac to fine powder, and put it in a closely stoppered bottle with 5 oz. of liquor ammoniæ. In the course of three or four days the shellac will dissolve, and form an excellent cement for fixing rubber to glass or metal. As the ammonia evaporates, it leaves a perfect air-, water-, and acid-proof luting of a permanent nature.

Acid-proof Tank.—Common pitch, or better still asphaltum, constitutes a very good acid-proof material for lining wood tanks. The pitch should be melted in a bucket (care being taken that the pitch does not catch fire) and then applied with a tar brush, working it well into the seams. Asphaltum has a higher melting point than pitch; it should be sprinkled on and ironed smooth with a hot iron. The irons used are somewhat like a tailor's iron, but very much larger, so that they retain the heat longer.

Acid-resisting Paint.—Procure 7 lb. of genuine white-lead in oil, and thin this down with a mixture of 2 parts of copal varnish and 1 part each of terebine, gold-size, and turpentine. This paint is acid-proof, and dries very hard on wood. Two thin coats give an egg-shell gloss. It is a white paint; for grey, add to the white lead 4 oz. of carbon black ground in oil.

Acid-resisting Surface on Wood.—A black wood-surfacing, to resist chemicals such as acids and alkalis, and even concentrated sulphuric acid for a few moments, is described in a communication by Mr. Frost, of Wisconsin University. Make a solution of 125 grammes copper sulphate, 125 grammes potassium chlorate, 1,000 grammes water; boil till dissolved. Make another solution of 150 grammes aniline hydrochlorate, 1,000 grammes water; or 120 grammes aniline oil, 180 grammes hydrochloric acid, and 1,000 grammes water. Using a brush, give two coats of the first-named solution; let them be applied hot, the second as soon as the first is dry. Then follow with two coats of the second solution, and give time to dry thoroughly. A coat of raw linseed oil is next laid on with a cloth or rubber, to get it very thin. Rub till well polished, then wash with hot soapsuds. Ten sq. yds. can be done at a cost of 1s. 3d. An occasional fresh rub with raw linseed oil will keep the surface good.

Acid Tank, Cement for.—The following is a recipe for a cement for sealing the joints of the glass plates for a hydrochloric acid tank. Melt by a gentle heat 100 parts of raw indiarubber, add 8 parts of tallow, and stir in dry slaked lime until the mass is pasty; then add 20 parts of red-lead, and apply the cement to the joints with a putty knife.

Benzoic Acid (*see* Benzoic).

Hydrochloric Acid, Muriatic Acid, or Spirit of Salts.—The liquid known as hydrochloric acid, as muriatic acid, or spirit of salts, is an aqueous solution of the pure muriatic acid, which is a colourless, invisible gas, possessing a pungent odour and an acid taste, and fuming when in contact with the atmosphere. This gas is irrespirable, uninflammable, has a specific gravity of 1·2695, and becomes liquid under a pressure of forty atmospheres. Muriates or hydrochlorates are combinations of this gas with a base. One method of producing the liquid ordinarily known as muriatic acid is:—Slowly pour 11 fl. oz. of sulphuric acid into 8 fl. oz. of water, and, when cold, add 12 avoirdupois oz. of dried chloride of sodium (common salt) contained in a quart flask; through a cork in the neck of the latter passes a glass tube which is connected with a three-necked wash-bottle, furnished with a safety tube, and containing 1 oz. of water. Heat the contents of the flask, conduct the disengaged gas to the wash-

bottle, and thence, by means of a glass tube, to a bottle containing 12½ fl. oz. of distilled water; in this bottle the tube dips ½ in. below the surface. Continue the process until 16½ fl. oz. of muriatic acid is obtained. The last bottle must be kept cold during the operation. The commercial acid is a secondary product of the manufacture of carbonate of soda.

Hydrofluoric Acid Bottles.—Bottles for hydrofluoric acid usually are of guttapercha, but this substance under the action of the acid becomes brittle and hard, and therefore is a source of danger; besides this, guttapercha is expensive. A convenient substitute is a glass bottle coated inside with wax; to coat the bottle, pour in the hot molten wax, shake well, and allow to cool, taking care that the neck is coated as well as the spout. Instead of a cork or glass stopper, use a stopper made of glazier's putty.

Hydrofluoric Acid for Cleaning Castings.—This application has been general only a short time. A few years ago it was regarded as a secret process, and published formulæ mentioned other ingredients merely for the mystification of the public. But any ingredient other than hydrofluoric acid and water is quite unnecessary. The usual recipe is 1 part acid to 10 parts water. In adding water, however, care should be taken to know the strength of the raw acid, as this is by no means uniform. The idea is to get a dip that will remove the sand perfectly and quickly, the operation requiring ten to fifteen minutes, depending on both the amount of sand to be removed and the condition of the pickle. Sand is quickly dissolved by the hydrofluoric acid, although it has very little effect upon the iron. By washing the cleaned castings in hot water after taking them from the pickle, they remain bright. Black iron-oxide is more easily removable with this acid than with either sulphuric acid or hydrochloric acid.

Nitric Acid.—Aquafortis is the common name given to commercial nitric acid; the name means "strong water." Strong nitric acid is employed as a depolariser in the porous cell of a Bunsen battery. When partly spent by this work, it is named "dipping aquafortis," and is used to clean copper and brass from oxide. It is also used with sulphuric acid and hydrochloric acid in making "dipping pickles," employed for various purposes in the plating shop. By itself, or when diluted with water, it will dissolve silver, copper, brass, and iron. When mixed with sulphuric acid, it will dissolve nickel. When mixed with muriatic acid, it will dissolve gold and platinum. It may thus be used in the preparation of plating solutions, but is not used afterwards in any addition to these solutions.

Picric Acid.—Picric acid is formed by the action of nitric acid upon phenol (carbolic acid). Picric acid is a pale yellow crystalline substance sometimes used in dyeing, as it yields a fine pale yellow upon silk. It has an intensely bitter taste, and stains the fingers a deep yellow. It melts on gentle heating, and may be poured from one vessel to another. If highly heated, it chars with a slight fizzle; if hammered, it does not fire, but if placed in contact with detonators, the shock to which their explosion gives rise causes the picric acid also to explode. It is principally used in the preparation of some of the high explosives. The manufacture and properties of picric acid, which, under the names of lyddite, melinite, etc., is so largely used in explosive shells, are thus described in an issue of "Chambers's Journal": Pure phenol or carbolic acid (the common disinfectant obtained from coal tar) is placed in a vessel with an equal amount of strong oil of vitriol (sulphuric acid), and the temperature raised to 212° F. Strong nitric acid (aquafortis) is then allowed to flow into the mixture, and, on cooling, a solid mass of yellow crystals is left. These crystals are filtered and drained, and afterwards washed with cold water, the residue being picric acid. The picrates of the alkalies, potash, soda, and ammonia, are very easily exploded by even a slight concussion, and the manufacture or use of them in Great Britain is not allowed; they have caused several very serious explosions abroad.

Salicylic Acid (*see* Salicylic).

Sulphuric Acid.—Sulphuric acid and oil of vitriol are names often given to the same material, but sometimes the concentrated form of sulphuric acid (40 parts sulphuric

oxide and 9 parts water) is known as oil of vitriol. The formula for this is H_2SO_4 or $H_2O_1SO_3$. It is a liquid, colourless and acid. It freezes at about $-14 \cdot 8°$ F., boils at 620° F., is colourless and oily, and has a density of 1·842. It has an acid taste and reaction, and when diluted with water it evolves great heat. To obtain a pure sulphuric acid, the acid must be made either from sulphur (brimstone) or from pyrites free from arsenic. The ordinary acid is heated in a series of platinum or glass retorts. In these the acid is concentrated, the water passing into a condenser; as soon as it attains a specific gravity of 1·84 it is syphoned out of the retorts. If still purer acid is wanted, then it is distilled, the first portion of the distillate is removed, and the remainder is separately collected.

Sulphuric Acid becoming Black.—Sulphuric acid left for some time in a bottle having a cork stopper may turn black. The acid will do quite well for charging electric batteries, as it is not altered in any way except that it now contains organic matter and carbon from the cork. Sulphuric acid should of course be kept in a glass-stoppered bottle.

Sulphuric Acid: Detecting.—Sulphuric acid is the only acid capable of decomposing cane sugar; therefore, to detect free sulphuric acid, evaporate the solution together with cane sugar to dryness on a water bath. A charred residue indicates the acid.

Sulphuric Acid: Filtering.—The best material for filtering sulphuric acid is glass wool; but this must not be packed too tight, or the filtration would be very slow, whilst if not packed tight enough, it would not remove the deposit. A preferable plan would be to keep a carboy of acid at rest until all the deposit has settled out, and then syphon out the clear acid; this can be done almost to the last fraction without raising the deposit if the syphon is filled with the acid before it is inserted, and if it is brought slowly down to near the bottom of the carboy a little above the deposit.

Sulphurous Acid.—The apparatus for making sulphurous acid consists of a fireclay retort, with an opening in the head into which is inserted a glass tube; the retort is connected to a series of three-necked bottles by means of rubber and glass tubes. If a large quantity of acid is required, the bottles should be of stoneware, 1 gal. or upwards in capacity. Sulphur is charged into the retort, and the latter is heated, while a current of air is passed through the glass tube; the sulphur burns to sulphur dioxide, which is absorbed by water placed in the three-necked (Woulff's) bottles.

Tartaric Acid.—This is one of the carbon compounds, and consists of 48 parts of carbon, 6 parts of hydrogen, and 96 parts of oxygen. It is a white solid body with an acid taste, and is present in many fruits, especially in ripe grapes. A crust forms during fermentation, and is known as argol or crude tartar. Tartaric acid is obtained from this when converted into calcium tartrate and decomposed with sulphuric acid. Cream of tartar is purified argol, potassium replacing half the hydrogen.

Vessels for Storing Acids.—The best utensils for storing fluoric and white acids are guttapercha bottles; but see under "Hydrofluoric Acid Bottles," p. 7. Leaden vessels may be employed, but lead is more often used for making tanks for dipping. An ordinary earthenware vessel coated with embossing black which has been allowed to get hard would serve for a time.

White Acid for Embossing Glass.—White acid or matting acid can be made by adding lump ammonia, piece by piece, to strong hydrofluoric acid until it ceases to work or effervesce. This requires to be well shaken each time previous to use. Despite every precaution, hydrofluoric acid is sometimes erratic in its action, but as a general rule it is not advisable to dilute strong acid and use straight away. Acid that has been in contact with glass several times may be relied on to bite more evenly. The breaking down of acid (that is, reducing the strength) is best done several days before use; shake the bottle at frequent intervals, but not immediately before pouring the acid on the glass. If by frequent use or by evaporation the acid gets weak, it should not be thrown away, but should be strengthened by adding pure strong acid; this will make the most reliable embossing medium. When an acid freshly diluted is used on glass, it will not bite evenly, not being matured.

This may sometimes be obviated by first going carefully over the exposed portions of the glass with a piece of wool dipped in the acid. Glass which is to be afterwards ground should be embossed to a good depth.

Agates

Agate, esteemed the least valuable of the precious stones, is a semi-pellucid, uncrystallised variety of quartz occurring usually as rounded nodules, and presenting various tints in the same specimen. Silica enters into its composition largely, and usually alumina and oxide of iron are present. The layers of chalcedony, carnelian, amethyst, common quartz, jasper, opal, and flint, form bands of variegated colours, and these bands in the polished agate, by reason of their peculiar and distinctive arrangements, give to the several varieties their respective names, such as ribbon-agate, fortification-agate, zone-agate, star-agate, moss-agate, clouded-agate, etc.; also agates are named from the substance which forms the predominant layers; for example, jasper-agate, flint-agate, etc. The cutting and polishing of agates is an industry at Oberstein, in Oldenburg, Germany, and in Scotland also, where they are known as Scotch pebbles. Agate is used in finger rings, for seals, beads, small handles, burnishers of many kinds, bearings in delicate mechanism, pivots, and for the knife-edges of weighing machinery, for which and other purposes its hardness peculiarly fits it.

Cutting and Polishing Agates.—Emery will cut such stones as agates, etc., and putty-powder, diamond dust, etc., will polish them. Lapidaries cut and polish stones on a lap wheel, the spindle of which is vertical. The powder is supplied by a hand wheel, and the lap is surrounded by a shield to prevent the polishing material flying off. The cutting and polishing materials are supplied to the laps in the form of a wet paste. A lap wheel of soft iron, fed with fine emery and water, will cut quickly if a stone such as an agate is held against it. Carborundum and water will cut still harder stones. A wooden lap wheel, fed with rouge and water, will polish soft stones well. Of course, this kind of work can be done slowly by hand without a lathe by rubbing the stones on flat slabs of iron, wood, etc., treated with the necessary cutting materials. A slitting cutter or disc is only used to bring a stone to a suitable size and shape before the true cutting and polishing is proceeded with, in much the same way as a wood carver might use a saw to remove surplus material before commencing to carve. As before mentioned, the cutting of facets upon gems is done on flat lap wheels revolving horizontally. The stone is embedded in cement (shellac, resin, or a similar kind), which is affixed to the end of a wooden or metal holder to grasp in the hand. The cement is warmed, and the stone set in it with the angle or face to be cut facing outwards. This is then held flat on the revolving lap until the emery or other cutting medium has produced a facet large enough. It is then smoothed and polished. During this process the holder is steadied against an upright pin or rest as close to the edge of the revolving lap as possible. When one facet is cut, the cement is warmed, and the stone turned round and again set in the cement, so that the place for the next facet is in the correct position. It is here that skill is required to judge the angles nicely and produce a shapely stone, as well as in the knowledge of the best way to cut it so as to produce brilliancy and even colouring.

Alabaster

Alabaster is a soft, semi-translucent white sulphate or carbonate of lime; sometimes it has veins of yellow, red, or brown. Derbyshire and Staffordshire appear to be the chief centres in England for the quarrying of alabaster, while Florence is the centre of the supply generally, the material being found very abundantly in Tuscany.

Cements for Alabaster.—The following cements are recommended for alabaster:—(1) Mix the curd formed by adding ½ pt. of vinegar to ½ pt. skimmed milk, with the whites of five eggs. Well beat together, and sift in sufficient powdered quicklime to form a paste. (2) Mix together by the aid of heat equal parts of plaster-of-Paris, yellow resin, and beeswax. (3) Sift powdered quicklime into rice glue. (4) Melt 2 parts of yellow resin, and stir in 1 part of plaster-of-Paris.

Apply hot to the warmed alabaster. (5) Perhaps the best cement for mending alabaster is white gelatine size, made by melting 1 part of gelatine in about 5 parts of water. (6) Plaster-of-Paris alone is often used as a cement, but only in places where the joints would not be seen, and it has not much strength.

Cleaning Alabaster.—Methods of cleaning alabaster and imitation alabaster are the following:—(1) Immerse in milk of lime (slaked lime in water) for some time, wash in water, and when dry, dust with a little French chalk. (2) Apply benzol or pure oil of turpentine. (3) Wash with soap and water containing a little ammonia. (4) Rub with soap and wash in hot water. If stained, apply fuller's earth, pipeclay, whiting, or quicklime for three or four hours and then wash off. (5) If very dirty, wash with dilute aquafortis or dilute muriatic acid. (6) Mix pumice powder with verjuice and allow to stand untouched for two hours. Then rub it into the alabaster with a sponge, and wash with fresh water applied with a linen cloth, afterwards drying with clean linen rags. Probably the most satisfactory method is to wash with hot water and white Castile soap applied with a clean rag; when the ornaments are quite clean, rinse them in clean warm water and dry with a clean white cloth.

Colouring Alabaster.—Generally it is only the imitation alabaster that is coloured. Thus pigments that are not decomposed by contact with sulphate or carbonate of lime are added to the gypsum whilst in the wet state. Busts, medallions, etc., are coloured with sienna in powder or ground in water. For architectural purposes, the colour is added to clear size, with which the plaster is worked up into the imitation material. Real alabaster may be coloured by applying hot liquid dyes or stains; the material itself should be sufficiently hot to cause the liquid to simmer. For blue stain, use tincture of litmus or an alkaline solution of indigo; for brown, use logwood extract; for crimson, use alkanet root dissolved in oil of turpentine; for gold, use a mixture of equal parts of white vitriol, sal-ammoniac, and verdigris; for green, use an alkaline solution of sap green; for red, use tincture of dragon's blood, alkanet root, or cochineal; and for yellow, a tincture of saffron.

Etching Alabaster.—Alabaster is etched by covering the surface, excepting those portions to be etched, with a solution of 1 part wax to 4 of turpentine, thickened with a little finely powdered white-lead. The alabaster is then immersed in dilute acetic or hydrochloric acid until the desired effect is obtained. The wax is then washed off with turpentine, and the etched parts are brushed with plaster-of-Paris. Imitation alabaster is etched in a similar manner, water being substituted for the acid. The immersion will occupy 20 to 50 hours.

Imitation Alabaster.—A common material often called alabaster is made of gypsum (plaster-of-Paris) by a special process, and is hardened by subjection to a heat of about 300° or 350° F., for from 12 to 24 hours. When almost cold, it is immersed in pure water or in a weak solution of alum for a few minutes. These operations have often to be repeated. Sometimes the imitation alabaster is suspended in an alum bath until the alum crystallises on the surface. The material is then polished with a wet cloth.

Polishing Alabaster.—Rough alabaster is polished in the following manner. It is first rubbed with pumice powder or dried Dutch rush (equisetum) and water, and afterwards with a paste of powdered and sifted slaked lime and water. The final lustre is given by friction with French chalk. Another method of polishing is first to smooth the surface with rifflers, scrapers, or glasspaper, and then to remove all tool marks with fine sandstone or gritstone, such as Robin Hood stone, water-of-Ayr stone, or snake stone. Then rub with pumice, either in lump or powder, and water, following with putty powder and water. Soap and water finish the polishing, or, instead of this, calcined tin may be applied with a linen muller in the form of a cushion. It must be remembered that alabaster is so soft that it will not take a very high polish. The most practical method probably will be to rub it with beeswax and turpentine, or finish with a coat of white hard spirit varnish.

Working Alabaster.—Real alabaster is worked in much the same way as marble, but it is much softer. It is easily turned in the lathe, strong chisels of the kind used by carpenters being employed for the straight work, and point tools for roughing out. For turning hollows, the chisels are ground round. The cutting angles are required to be more obtuse than for cutting wood. Alabaster is also easily worked in the lathe with tools such as are used in ivory and brass turning. It is a common practice to construct alabaster ornaments in two or more pieces, and then to cement these together.

Alarm, Electric (*see* Electric Alarm)

Album

Cleaning Album.—If the leaves are very dirty, the only way to make a really satisfactory job will be to have them relined with fresh paper. They may be cleaned, however, by rubbing with bread crumbs. Take a piece of a loaf about one day old and rub it in the hands, allowing the crumbs to fall on the leaf to be cleaned. Rub the leaf carefully with the open hand, using the four fingers. As a certain amount of pressure will have to be employed, care must be taken that the leaf does not get torn. Brush away the crumbs carefully afterwards. It may be necessary to use ink-eraser for some parts, but this must be used very carefully, as it is liable to rub holes in the paper.

Repairing and Adding to Album.—For repairing or adding to albums, it is not possible to buy papers already cut, as, owing to the many different sizes and positions of the openings, etc., it would be impossible to keep a stock. For cutting the papers, procure some good white paper; a printing paper will be best, a useful size being demy, and of this about 24 lb. to the ream is a good quality. Cut up a number of sheets a little larger than the leaves of the album, and with one of the edges straight and smooth. Next make a template of sheet zinc of the size of the present openings in the album leaves; or if the openings are the ordinary cabinet or carte-le-visite sizes, procure glass cutting shapes from a dealer in photographic materials. Get also a large sheet of zinc or glass for cutting on. Take a sheet of paper and mark with a pencil the position of the opening, measuring with compasses from the back edge of the old paper and the top edge of the leaf, and making the marks on the paper from the smooth edge already mentioned. Then place the template to the lines and, having the zinc or glass sheet below the paper, cut round with a sharp knife. Go over the album leaves and tear away the old paper from the holes so as to expose the cardboard underneath, taking notice where the paper has been pasted to the board. After all this has been made as smooth as possible, fasten on the new paper with flour paste of such consistency that it will work easily with a brush, pasting over the cardboard and taking care not to cover any part where paste had not been formerly. Now lay on a sheet of paper with the holes, placing the smooth edge close to the joint at the back of the leaf; over this lay a sheet of waste paper, and rub over the whole surface with the hand to ensure the new covering sticking to the leaf. All the leaves are treated in the same manner, and the album is closed up and put under a heavy weight until dry. The edges of the leaves must then be trimmed with scissors or a sharp knife.

Albumen

Albumen (white of egg) is a very unstable substance, and unless a large quantity of preservative is used it will not keep for any length of time. The best preservative is a little carbolic acid. This is poisonous. Oil of cloves or salicylic acid will serve for a time. There are no non-poisonous preservatives sufficiently powerful to preserve albumen effectually.

Dissolving Blood Albumen.—Blood albumen is best dissolved in cold water, and it may be made of any required consistency by varying the quantity of water added. If required, the material may be thickened by the addition of dextrine or gum tragacanth.

Alcohol

Alcohol is one member of a large series of organic products known by the generic term of alcohols. The lowest member of

this series is methyl alcohol, which is contained in wood spirit; the next is ethyl alcohol, which is the ordinary alcohol; higher still are propyl alcohol and amyl alcohol, contained in fusel oil. There are also several others. Ordinary or ethyl alcohol is formed by the fermentation of sugar by means of yeast. There are two stages in the fermentation; in the first place, cane sugar takes up water and becomes "invert" sugar. This is then decomposed, yielding alcohol and carbonic acid. There are other minor products, but alcohol and carbonic acid are the principal ones. Starch in the form of potato starch, rice, barley, and Indian corn are also used in the preparation of alcohol, but they have first to be converted into sugar. This is done either with malt or with sulphuric acid. The alcohol produced is extremely weak; it is then distilled carefully, and leaves most of the water and all the solid matter in the still. Another distillation produces rectified spirit (spirit of wine) containing 84 per cent. by weight of alcohol. To prepare stronger alcohol, distillation should be repeated several times with quicklime, the final distillation yielding absolute alcohol, which should contain 95 to 99 per cent. of alcohol. Proof spirit contains 49 per cent. by weight of alcohol. Methylated spirit formerly was rectified spirit to which 10 per cent. of wood spirit, or $\frac{3}{8}$ per cent. of petroleum naphtha, had been added to render it undrinkable; it passes free of duty for manufacturing purposes. Its constituent parts now are shown in a later paragraph. Whisky is made from malt and distilled as for rectified spirit; rum is made from molasses, gin from malt, etc., and brandy from French wines. Brandy, whisky, and rum must not be sold weaker than 25° under proof, that is, containing not less than 40 per cent. of alcohol; and gin not less than 35° below proof, containing 37 per cent. of alcohol. For testing, Sykes's hydrometer is employed. Potato spirit made from potatoes, and corn spirit made from Indian corn or maize, are common alcohols containing much fusel oil. Still commoner alcohol is made from beet treacle. The three last are made and used largely in Germany, but not much in Great Britain. Wines contain from 10 to 20 per cent. of alcohol; beer as a rule contains about 5 per cent.

Methylated Finish. — Methylated finish, owing to its cheapness, is much used by spirit varnish manufacturers; it is prepared by adding $1\frac{1}{2}$ lb. of resin to 1 cwt. of methylated spirit, this being an Excise regulation to make the spirit undrinkable. When mixed with water it resembles milk, and throws down a white precipitate.

Methylated Spirit.—Only two kinds of methylated spirit are recognised by the British Excise authorities after October 1, 1906, namely, industrial spirit, consisting for not less than one-nineteenth of its bulk of wood naphtha or some other permitted denaturing agent; and mineralised spirit of which the bulk contains not less than one-ninth of wood naphtha, etc., and in addition not less than three-eighths of one per cent. by volume of approved mineral naphtha or petroleum oil. The "Engineer" states that the "industrial" spirit takes the place of the former ordinary methylated spirit, but it will not be permitted to be used for lighting, heating, or motive power, the mineralised spirit being the only kind that may in future be employed for such purposes. Retailers may keep in stock 200 gal. of the mineralised spirit; 4 gal. is the maximum amount to be retailed at one time to one person. For denaturing alcohol in France, there is added 10 per cent. of methylene containing 0·5 per cent. of heavy benzine of dark colour and unpleasant odour—a method which diminishes calorific value and increases the fouling of engine cylinders and valves. Italian motor alcohol, containing about 1 per cent. of benzol, is treated with 8·5 per cent. of impure methylene and 0·66 per cent. of pyridine, and for the sake of distinction the spirit is coloured violet with aniline. Swiss alcohol contains 5 per cent. of methylene, 0·33 per cent. of pyridine, and 2·2 per cent. of oil of acetone, which gives a very disagreeable odour and an opalescent yellow colouring. In Austria, alcohol containing at least 2·5 per cent. of benzol or mineral hydrocarbon is denatured with only 0·5 per cent. of methylene and a trace of pyridine, and is coloured violet. In Germany, motor alcohol containing a minimum of 2 per cent. of benzol is denatured

with 1 per cent. of methylene and a small quantity of pyridine, and is given a violet tinge.

"Solid Alcohol."—This has been introduced in many forms. One litre of denaturalised alcohol (90 per cent.) is heated in a 2-litre flask on a water bath to about 60° C. (140° F.), and then mixed with from 28 to 30 grammes of well-dried, rasped Venetian soap and 2 grammes of gum lac. Repeated shaking produces a complete solution, and this is put, whilst still warm, into metallic vessels, these being at once closed up, and the solution allowed to cool. The gum lac prevents the evaporation of the alcohol. On lighting the "solid spirit," the Venetian soap remains behind.

Alum

Alum Baskets.—To make alum baskets, boil alum with water and add more alum until the water will dissolve no more. While the solution is still warm, a small woven wire basket should be suspended in it, and left in it until the crystals which form upon it have become sufficiently large; it should then be removed and allowed to drain. The crystals may be coloured violet by adding to the solution chrome alum, or yellow by adding iron alum; or a solution of any aniline dye in spirit may be brushed over the crystals, after the basket is removed from the solution and dried.

Burnt Alum.—Powdered burnt alum as used for bird stuffing and skin preserving is made as follows:—Procure from a chemist the potash alum, not the common or ammonia alum. Place a quantity of this in an iron ladle and heat it over a Bunsen burner or perfectly clear fire, when the alum will froth up considerably; the heating must be continued till the frothing ceases. The light, friable material is burnt alum; after being powdered it is ready for use.

Alumina Soap (*see* Waterproofing)

Aluminium

Aluminium (symbol Al, melting point varying from 1,050° to 1,292° F., specific gravity 2·6), when of 98·5 per cent. purity, is bright white in colour, somewhat resembling silver, though its appearance depends much on the temperature at which it has been worked. It is capable of taking a high polish. Its melting point may be increased greatly if impurities are present or if it is alloyed with another metal. Aluminium is only slightly elastic; it is fairly malleable and ductile, but these latter properties are impaired by the presence of its two chief impurities, silicon and iron. If of more than 99 per cent. purity, it can be rolled, it is said, into leaves $\frac{1}{40000}$ in. thick, in this respect being inferior only to gold. Aluminium has a tensile strength of 7 tons to the sq. in. When pure, it is non-corrosive and resists the oxidising action of the atmosphere, but this advantage has to be partly sacrificed to obtain increased hardness and elasticity by adding small quantities of copper, nickel, or zinc. It dissolves in hydrochloric acid and in most solutions of the alkalis, but it is only slightly affected by dilute sulphuric acid, and not at all by nitric acid. Rolled or forged, it breaks with a fine silky fracture. Aluminium is not found in a metallic state, but when in combination with oxygen, various alkalis, fluorine, silicon, and acids, it is the base of many clays and soils. Corundum and emery are aluminium oxides. The three best known electrical methods of producing aluminium are the Cowles, the Hall, and the Hérault, the first-named depending on the heating effect of the electric current and producing aluminium alloys only; by the other two methods aluminium salts are submitted to electrolytic action at a high temperature, pure metal being in these cases produced.

Aluminium Paint.—The vehicle for aluminium powder is a good hard clear varnish. Unless the worker has exceptional facilities, it will be best to purchase a high-class enamel varnish. If the varnish is home-made, the following may be allowed: 3 lb. of gum dammar, 3 lb. of Canada balsam, and 1 gal. of turpentine, dissolved by churning and, perhaps, very slight heating. Two pounds of aluminium powder will require about 1 gal. of varnish. Smoothness comes by very gradual mechanical agitation; for this, use a small paint mixer. One-fourth varnish should be thoroughly combined with the powder at a time. If required, thin down with turpentine

Aluminium Paint, Coating Cycle with.—Previous to applying aluminium paint, the machine should be thoroughly cleaned, all the old enamel scraped or burnt off, and the metal well rubbed down with emery cloth. Two coats of paint should be given, the first coat being rubbed down smooth with powdered pumice and water, and thoroughly dried and dusted, before applying the second coat. It will add to the durability and appearance of the job if a coat of pale oak varnish be given. To apply the paint, use a soft badger or camel-hair brush. Do the work in a warm room free from dust and draughts, and, if an enamelling stove is available, stove each coat at about 200° F. for half an hour or so.

Aluminium Paint, Non-smelling.—Aluminium may be worked up with a washable distemper varnish that is wholesome and non-smelling, and highly suitable for coating the insides of biscuit tins. This varnish is made from gum arabic dissolved in hot water to the consistency of honey, and about 1 oz. of borax per 1 lb. of gum stirred in to render the mass stiff. The compound is then thinned down with more hot water to the thickness of an ordinary varnish, strained through muslin, and bottled for use. If the oil varnish paint be preferred for the purpose above noted, the addition of a few drops of essential oil of verbena will give an agreeable odour, and will in course of time leave a sweet and fresh flavour without a noticeable smell.

Blackening Aluminium.—Apply, without heating the metal, a coating of vegetable black mixed with methylated spirit and a little lacquer varnish. The mixture should be applied cold with a brush. The spirit soon evaporates. It may be necessary to give several coats before the black adheres everywhere evenly. For a chemical method, dilute arsenic bronze with an equal quantity of water. First the exposed parts of the surface should be curled, not straight-grained, with emery paper; then the metal should be quickly dipped into the fluid, and as sharply withdrawn, and drained. If on the first immersion the bronze has not taken well all over, the process should be repeated. If the preparation is too strong, there is a danger that the acid will eat away the metal. A recipe for arsenic bronze is:—Hydrochloric acid, 12 lb.; sulphate of iron, 1 lb.; pure white arsenic, 1 lb. To this, for aluminium, must be added an equal quantity of water; and when the metal has blackened, it should be dried in a mixture of blacklead and sawdust. Only sufficient sawdust is required to soak up the moisture. The exposed parts may then be lacquered.

Cementing Aluminium to Linoleum.—A suitable cement may be made by covering glue with strong acetic acid, and when it is softened, melting down by gentle heat. It is applied in a similar manner to glue, but takes longer to harden, and is very much stronger. It will cement almost anything.

Cementing Aluminium to Wood.—A cement that is suitable for uniting thin sheet aluminium to wood or iron can be made from Canada balsam; the thick syrup should be placed in a tin and baked in an oven until the mass becomes hard on cooling. The balsam should then be broken up, placed in a wide-mouth bottle, and just covered with benzol. After standing for a night, the cement should be melted by placing the bottle in hot water; the cement is then applied, and the articles are pressed together. This cement sets almost immediately after it becomes cold, and it is very adhesive.

Cleaning Aluminium Utensils. — If an aluminium utensil is put away dirty in a damp place, it may in time darken, and this darkening is largely due to the accumulation of dirt, etc., and to some extent also to chemical action upon the metal itself—a true tarnish; but discoloration is avoided by occasional washing and rubbing. Wash each utensil in hot water and plenty of soapsuds, dry it with a cloth, and place it empty on a hot stove for a few minutes to dry quickly and thoroughly. Do not boil ashes, lye, or alkalis, such as soda, potash, ammonia, etc., in an aluminium utensil, as these substances attack the metal and blacken it, and water containing any of them will affect the utensils in a similar manner. Water containing sewage or other contamination will discolour an aluminium utensil, this being due largely to the presence of ammonia. Should the aluminium become discoloured, the fault lies with the

water used. This discoloration may be prevented by using water which has previously been well boiled. The insides of aluminium utensils may, when necessary, be scoured with Bath brick dust or special preparations largely advertised. Use any good metal polish for the outside. For freshening aluminium articles, petrol (motor-car spirit) is useful. Aluminium does not tarnish very easily, but constant handling causes fingermarks which, added to the dust that readily gathers, especially on the frosted parts, often make the metal dim and dull. The articles should be washed in petrol, rubbing with a soft cloth; let them dry by evaporation. The inside of the articles may be rubbed over with a little moistened bicarbonate of soda on a cloth, and then cleaned with the petrol. Any petroleum spirit such as naphtha, benzoline, etc., can be used instead of the petrol. Do not bring these near a naked flame.

Enamelling Aluminium.—If the surface of the metal is to be coated with an enamel paint such as Aspinall's, the latter may be obtained from any oilman. The surface must be prepared by dipping in a bath composed of 10 per cent. caustic soda and 2½ per cent. common salt, dissolved in water in an iron vessel. The solution is then heated, but not to boiling point. The article is next immersed for fifteen or twenty seconds, until it is nearly black and its surface is covered with air bubbles. Then rinse in plenty of cold water, and scrub with a fibre brush; repeat this operation, and immerse the metal in concentrated nitric acid until the surface is quite white; again wash in cold water, and dry in sawdust. The enamel can then be applied with a brush. A coating for aluminium ware, obtainable by a process patented in Germany, produces a coloured and durable surface adapted to enamelling. The aluminium is covered with a solution of chloride of mercury to obtain a coating of aluminium amalgam. After this is removed a very active oxidisation of the surface is said to take place, which action may be interrupted by strong heating, and the aluminium oxide will serve as a foundation for the enamel. The action of heat may be employed to give different coloured coatings, grey, green, brown, or black. They are said to resist the action of fire and render the aluminium more difficult to melt.

Etching Aluminium.—In etching aluminium, a resist of beeswax is scratched with a hard point. The etching fluid is hydrochloric acid, or a solution of either potash or soda, nitric acid having no effect.

Frosting Aluminium.—For frosting aluminium, prepare a dipping bath as follows:—In an iron vessel, add 10 parts of caustic soda to 90 parts of cold water, and saturate with about 2½ parts of common salt. This solution is then heated, but must not boil. The article is plunged for from fifteen to twenty seconds in the bath, so as to become nearly black on the surface and covered with air bubbles; it is then washed freely in cold water, well scrubbed with a fibre brush, again dipped and washed, then placed in a slate, aluminium, or earthenware vessel containing concentrated nitric acid, until the metal becomes quite white. Again rinse in cold water, and finally place in warm dry sawdust. Metal thus treated takes a very beautiful matt, which keeps for an indefinite period in the air and has a silky appearance, and the frosted aluminium does not blacken the hands.

Jointing Aluminium Wire.—To joint aluminium wire, a recent method is to take a sheet of thin aluminium, and to make a pair of parallel connected tubes from it by rolling in two opposite edges. The ends of the wires to be joined are inserted in these tubes from opposite ends, and both wires and sheet are further twisted till a firm joint is secured. The part can readily be made air-proof and damp-proof by coating it in the usual way.

Polishing Aluminium.—The British Aluminium Co. recommend the following methods for polishing aluminium. One method is to place in a bottle equal parts by weight of olive oil and rum, and shake until an emulsified mass results; this is used as an ordinary polishing paste. A second method is to mix together fine emery powder and tallow until a paste of suitable stiffness for use with a rag mop is formed; a final polish of great brilliancy is given by using rouge and turps on the mop. A third method is to use Vienna chalk on an ordinary chamois skin buffing-wheel, and

finish with rouge; or to use a rag mop with very finely powdered Vienna chalk. Polished aluminium has a slightly bluish tint like tin, but this can be improved.

Soldering Aluminium.—The difficulties in soldering aluminium arise from the high heat conductivity of this metal, and from the fact that ordinary soldering fluxes will not clean the surface of the metal. The heat is conveyed from the soldering bit and from the solder so rapidly that the solder does not become sufficiently liquid to flow readily. To overcome this difficulty, the spreading of the heat must be restricted. The difficulty increases with the size and thickness of the pieces of aluminium to be soldered. The pieces should, if possible, be warmed beforehand, and for large work the soldering bit should be hotter than usual. Aluminium is popularly supposed to be non-oxidisable, but really the surface is covered with a very thin film of oxide, which prevents the solder from alloying with the aluminium. If this coating cannot be removed with emery cloth or file, the edges to be joined should be dipped in a solution of 1 part of hydrochloric acid, 10 parts of nitric acid, and 50 parts of water; or dip first into a caustic soda solution and then into strong sulphuric acid. Soldered joints in aluminium, even when well made, are not as strong as soldered joints in other metals, and as a result of the galvanic action between the solder and the aluminium the joint will gradually disintegrate. Especially is this the case in damp situations favourable to galvanic action. In dry places, a soldered joint may last for a long time. In view of the high heat conductivity of aluminium, it is advisable to use a solder which will melt at a low temperature. Most of the better solders for aluminium contain a little phosphor tin. For soldering aluminium, Prof. E. Wilson has given the following instructions bearing out the information given above:—With benzine remove all dirt and grease from the surface of the metal, apply the solder with a copper-bit, and when the molten solder covers the surface of the metal, scratch through the solder with a wire brush to remove the oxide. These operations must be done very quickly. Prof. Wilson gives the proportions of a suitable solder as follows:—4 lb. of block tin, 2 lb. of phosphor tin (containing 10 per cent. of phosphorus), ½ lb. of lead, and 1 lb. of spelter. Another method of soldering aluminium is to use a solder made up of bismuth, 10 parts; zinc, 30 parts; and pure tin, 60 parts. Melt the bismuth and zinc, add the tin, and pour the whole into moulds to make sticks about 1 ft. long and about the size of a pencil. Hold the pieces to be soldered in a vice, heat them gently with a blowpipe flame until they are hot enough to melt the solder when it is applied, then scrape the surface with a file or scraper. Melt the solder on to each piece, and work it around with a short rod of nickel-aluminium; hold the parts together in the flame, remove the blowpipe, and allow the parts to cool slowly. The following solder has been highly recommended: 1 part of aluminium, 1 of phosphor tin, 11 of zinc, and 29 of tin. To avoid loss of the more easily volatile of these metals, the aluminium is melted first, the zinc is added in small pieces, then the tin in small pieces, and lastly the phosphor tin. Acid is not used as a soldering flux; instead, the surfaces to be joined are covered with a thin coat of the solder in the usual way, and then brought together and heated with the soldering bit or a blowpipe or torch until the solder already upon them is melted, when pressure is applied and the joint is made. Aluminium, says one authority, must be heated to about 660° F. before it can be soldered.

Soldering Aluminium Bronze.—For soldering aluminium bronze containing less than 5 per cent. of aluminium, tin solder can be used; if the aluminium exceeds that amount, use a solder of zinc and cadmium. The surfaces of the alloy are cleaned, a layer or two of solder is applied, the excess removed with a brass scratch-brush, and soldering then proceeds as usual. For brazing, the spelter may be a mixture of 52 per cent. copper, 46 per cent. zinc, and 2 per cent. tin. With large pieces of the alloy, direct burning on by fusion is said to answer very well.

Welding Aluminium.—The Heræus process of welding aluminium is to clean the two surfaces, put them together, and heat them carefully to the temperature at which the

metal begins to soften (approximately 600° C. or 1.112° F.); this temperature is maintained constant, and the metal is hammered meanwhile until the weld is perfect. If the temperature is too high, the aluminium becomes short or granular, and begins to oxidise, a good weld then being impossible. A successfully welded piece possesses throughout the same physical qualities, tensile strength, flexibility, and conductivity for heat and for electricity as a piece of aluminium cast in one. Aluminium rods can be welded, it is said, by exposing their ends to a blowpipe heat, which causes the formation of a kind of bag or outer case of oxide, inside which is pure molten metal. In this state the rods are forced together, the flame is shielded off, and a cold douche of water is directed on the weld. The bursting of the bag of oxide allows the two molten ends to come together in pure metallic contact, and the douche solidifies the union. The process thus resembles that of electric welding. Stated briefly, it may be said that, as with cast-iron, the welding point is the fusion point, if only the fused parts be approximately free of oxide. This process is that of Sherard, Cowper-Coles and Co., and as thus described by the "American Machinist," seems calculated to effect this result, and it is intended to apply the method to tubes by means of an internal mandrel which will prevent the escape of metal inwards.

Working Aluminium.—In working aluminium with steel tools, difficulty is experienced owing to its excessive softness. It is apt to ruffle when being turned, planed, or filed, and the edge of the tool becomes dulled owing to particles of aluminium adhering to it. In consequence, the aluminium is torn rather than cut, and the edges easily become rough and uneven. This can be prevented by taking only small portions or chips at a time, and supplying oil plentifully and continuously on the metal and the steel. Double-cut files become clogged much more quickly than single-cut files; the quickest way to clean files is to place them in a concentrated soda-lye, washing thoroughly in running water, and drying them immediately afterwards in sawdust. Aluminium is often worked more satisfactorily by grinding with soft and granular sandstone than by filing, turning, or planing. With a circular saw well set and oiled the metal can be cut as easily as wood. A chisel will slip on the soft metal; this slipping can be avoided by sprinkling with a mixture of four parts oil of turpentine and one part stearic acid (or olive oil with rum).

Writing on Glass with Aluminium (*see* Glass).

Amalgam (*see* Mercury)

Amber

Amber (known in mineralogy as succinite) is the mineralised or fossil resin of an extinct pine-tree (probably Pinites succinifer), and though usually its colour is a transparent pale yellow, often it is reddish or brownish, and sometimes tinged with green, blue, or violet. Some varieties of amber are almost opaque. The most valuable amber is of an opaque lemon colour, and is known as fat amber. Amber occurs in beds of lignite and in alluvial soils, but it is found in greatest abundance on the shores of the Baltic, between Konigsberg and Memel, where it is thrown up by the sea; its form may be round, irregular lumps, grains, or drops. It is hard, rather brittle, and has a perfectly conchoidal fracture; that is, the surface of the fracture has convex elevations and concave depressions. Amber becomes negatively electric by friction, and the power of electrified amber to attract light bodies was known as early as 600 B.C. Its specific gravity varies from 1·05 to 1·07, sometimes reaching 1·1. It is without taste or smell, but when heated by friction or otherwise emits an agreeable odour; it burns with a clear flame and a pleasant smell, leaving about 1 per cent. of ash; it melts at 536° F. When its soluble constituents have been dissolved out by means of ether, amber has a similar composition to camphor—$C_{10}H_{16}O$. On distillation, amber yields an empyreumatic oil which is a mixture of hydrocarbons and succinic acid. Sometimes amber encloses crustacea, as well as insects belonging to species which do not exist now; amber has been found enclosing leaves.

Amber Varnish.—The usual method of melting amber for varnish making is to fuse

the amber in a copper vessel by means of a red fire; it usually melts at about 600° F.; it is then soluble in turpentine, benzine, naphtha, linseed and other oils. When cold it is insoluble in water, acetic acid, benzine, and carbon bisulphide, and is slightly soluble in alcohol, chloroform, turpentine, and many essential oils. Use amber of the best quality; this is the most transparent, whilst the inferior kinds are of a very dark colour and contain vegetable matter. (*See also* Violin, Varnish for.)

Cement for Amber.—Cement for amber may be made by dissolving gum copal in ether to form a syrupy fluid. The broken pieces should be warmed slightly, the cement quickly applied, and the two pieces brought close together and bound with wire. The cement sets quickly, and the excess may be pared off with a sharp knife. Another method is to heat the surfaces to be joined, and apply boiled linseed oil. Clamp firmly until united. A solution of potash, or a solution of mastic in linseed oil, may replace the boiled oil. (*See also* Tobacco Pipes.)

Moulding Amber.—If amber is to be moulded, it should be boiled in rape or linseed oil for several hours; this makes it plastic, when it can easily be moulded. This process softens but does not dissolve it.

Polishing Amber.—A simple process of polishing amber is to smooth it with whetstone and water, and then rub with whiting and water, followed by oil applied on a piece of flannel. When the friction heats and electrifies the amber, lay it aside to cool, or it may fly to pieces. The more general method of polishing amber is the following:—First it is filed to a fairly smooth surface, which is improved by rubbing with Trent sand and water or with scraped Flanders brick and water applied with a flannel. It is then rubbed with rottenstone and oil with a flannel, followed by dry rottenstone applied with the palm of the hand. Amber turned in the lathe is smoothed with glasspaper, and polished with rottenstone and oil. The lapidary polishes amber first on an iron lap with diamond dust and oil; then on a lead lap with coarse emery and water, followed by fine emery and water; then with flour emery and water on a mahogany lap; then on a list mill with pumice powder and water; and, finally, on a leather lap or piece of buff leather with fine putty powder and water. Sometimes moist putty powder applied by the palm of the hand follows the leather lap. Amber that has facets is polished on pewter laps with crocus. Except that the amber is held in the unaided fingers, the process resembles the cutting and polishing of gems.

Testing Amber.—Amber may be tested by—(1) Warming it slightly; artificial amber will then smell of camphor. (2) Holding a small chip in a flame, when amber melts and burns slowly, whilst the artificial amber burns vigorously. (3) By weighing. The real is not so heavy, bulk for bulk, as the artificial substance. To distinguish amber from fossil copal, heat a particle and hold a piece of moistened lead acetate test paper in the fumes. If it is amber, the paper will be blackened; if copal, the paper will not be discoloured. The reason for this is that amber contains sulphur, whilst copal does not.

Working Amber.—Amber may be worked in the lathe, the rough amber first being sawn to shape with a bow saw having a fine wire for the blade, tripoli or emery powder being used with it. Whilst the amber runs in the lathe, it may be heated from beneath by a small lamp or a pan of charcoal, as then it softens and is more easily worked; worked cold, it is liable to chip. For the same reason, when drilling or tapping amber, warm the tool first, and allow it to remain in the amber whilst the latter hardens again; remember that if the tools are made too hot, the amber will be spoilt.

Ammonia

This is one of the most important alkalis.

Liquor Ammoniæ.—Powdered sal-ammoniac is mixed with moist slaked lime and heated to produce ammonia gas, which must be collected by displacement or over mercury. If this gas be turned into a considerable volume of water, liquor ammoniæ (liquid ammonia) is produced. This evolves the gas even at low temperatures, and so much of it is given off by heat that, if the liquid occupies a carboy, it would be dangerous to fasten the cork tight, as the carboy might burst. A small hole should be bored

through the cork, so that any vapour which may be formed may escape from the carboy; the cork will not then be blown out.

Ammonium Chloride (*see* Sal-ammoniac)

Anaglypta (*see* Wall-paper)

Aneroid (*see* Barometer, Aneroid)

Aniline

This is the name of a huge class of dyes made from coal-tar. A variety of aniline colours easily applied is obtainable from a chemist.

Removing Aniline Stains.—To remove aniline stains, which often are very stubborn, an excellent medium is liquid opodeldoc—a soapy, camphorated liniment. After its use the stains are said to disappear at once.

Ants

To get rid of ants is usually a troublesome affairs as it is often very difficult to find their nests, which not infrequently are located at a considerable distance from the spot at which the ants are seen when in search of food. Ants form a perfect trail from a food supply to their nest, and a little patient tracking will invariably run them to earth. But where the nests are inaccessible, make the trail unsavoury by plentifully besprinkling it with some strong-smelling substance —chloride of lime, guano, and carbolic powder, for instance. A gardening paper says of ant-holes, that sometimes boiling water or some insecticide can be poured in without much trouble, in which cases paraffin oil, sulphuric or carbolic acid, diluted with ten or twelve times their bulk of water, should be used. Some well-worked clay should, if possible, be placed round the entrance to the nest in such a way as to form a sort of cup into which the insecticide may be poured. The ants will crowd into traps, such as bones not picked quite clean, pieces of sponge soaked in treacle, or pieces of meat. When well covered, the traps should be dipped into boiling water. A saucerful of treacle in which a tablespoonful of Paris-green has been mixed, placed near their runs, has been found most effectual in poisoning them. If a nest be found among the roots of a plant in a pot, both plant and pot may be immersed in water for five or six hours, which will drown all the grubs and eggs. When nests are formed in the open ground, they may be dug up and thrown into boiling water, or water with a strong admixture of carbolic acid; or the nest may be merely laid open with a spade, and a mixture of liquid manure and pearlash of about the consistence of cream poured in. In garden borders which cannot be disturbed, a flower pot, with the bottom closed, should be partly filled with leaves—raspberry leaves are specially recommended—and inverted over the entrance to the nest; then keep the ground near the nests well watered, and the ants will soon leave the damp earth and seek shelter in the pot, and in a fortnight will have filled it up with their nest; the pot and its contents can then be removed and destroyed. If an ants' nest is thrown into a fowl-run the birds will quickly eat all the cocoons - usually, but erroneously, termed ants' eggs. Other methods are: – Try to discover the nests, and on the mouths of these drop some quicklime and wash it in with boiling water. Or camphor may be dissolved in spirit of wine, then mixed with water and poured upon the haunts. Tobacco water also has been found effectual. To drive ants out of cupboards, camphor, tar, creosote, or chloride of lime may be employed, but these substances cannot be used in a pantry, so the shelves and floor should be scrubbed with carbolic soap. To catch the ants, cover some plates with a syrup composed of sugar and water, and place these plates in the infested places; destroy any ants found upon them by dipping the plates and contents into boiling water. When they are somewhat thinned by the syrup plan, follow with one of the methods given above; or place on plates a mixture of sugar, beer, and arsenic. Fly papers might also be tried. Pepper and Keating's insect powder have been found successful. Sprinkle all the shelves with a little of the powder; this will kill all insects. Then see where they come from, follow the trail, and sprinkle the powder as far as the trail can be followed; this will stop their coming, and after a time they will no doubt lose the scent. From time to time a little insect powder may be sprinkled near cupboards as a deterrent.

Anvil

A noiseless anvil for use, say, in a workshop at the top of a house, can be made in the following way, as described in the "Bazaar": Get an old iron can, as big as possible—a printing-ink drum is very suitable. Cut out a disc of wood which fits the recess at the bottom and projects slightly—say ¼ in.—so that when the can is standing on its bottom no part of it touches the ground. Now fill the can with turnings of iron, brass, etc., putting the long turnings at the bottom, and ramming them down well, and then using the finer stuff for levelling up. Then cut a disc of hardwood which makes a sliding fit inside the can; upon this disc the anvil stands. Place the disc in the barrel; and if there is from 20 lb. to 30 lb. of turnings in the can, the worker can swing a sledge upon the anvil and get no more noise than the ring of the metal. The reason is that the shavings absorb what is left of the blow after it has passed through the anvil. For the first week or two the contents of the can will constantly need levelling; but after that they will have silted down to a fairly compact mass, which, however, will still possess the absorbing properties already mentioned.

Aquafortis (*see* Acid, Nitric)

Aquarium

Aquarium Cements.—So-called non-poisonous cements are not very effective. All harmful results to the water may be avoided by allowing the cement a week or so to dry hard, and then applying three good coats of shellac spirit varnish to all those parts inside the aquarium touched by the cement.

Cements containing Guttapercha.—(1) Take 25 parts of guttapercha, carefully melted, 75 parts of ground pumice-stone, and 100 parts of Burgundy pitch; mix and melt together. (2) Take 3 parts of guttapercha, 1 part Stockholm tar, and 1 part pitch; warm and mix. (3) This is suitable for joining sheets of glass together. Take 2 parts of pitch and 1 part of guttapercha; mix together, and apply to the joints hot, and slightly warm the glasses before pressing them in position. The seams may be neatly finished on the outside by slightly heating a small poker and running it along the cement. A mixture of gold-size and zinc oxide serves the same purpose.

Cements containing Red-lead or White-lead.—(4) Take ½ lb. of best white-lead ground in oil, ½ lb. red-lead, dry, and ½ lb. litharge, dry; knead the last two into the first. This produces 1½ lb. of one of the best putties for resisting water. It soon hardens. (5) Take ½ gill gold-size, 2 gills red-lead, 1½ gills litharge, and sufficient silver sand to make a thick paste. This sets in about two days. (6) Mix together boiled linseed oil, litharge, red-lead, and white-lead, using white-lead in the largest proportion; spread on flannel and apply to the joints.

Cements containing Resin.—(7) Take 10 parts, by measure, of litharge, 10 of plaster-of-Paris, 10 of dry white sand, 1 of finely powdered resin, and mix them when wanted for use into a stiff putty with boiled linseed oil. This will stick to wood, stone, metal, or glass, and hardens under water. It is particularly good for marine aquaria, as it resists the action of salt water. Allow at least three days for drying. (8) Melt and mix 8 parts of common resin and 1 part of calcined plaster; add 1 part of boiled oil, and apply warm. (9) Take 6 parts of whiting, 3 of plaster-of-Paris, 3 of white sand, 3 of litharge, and 1 of powdered resin; mix thoroughly, and make into a putty with best oil varnish. Leave the glass a week before disturbing. (10) Break up in an old saucepan ½ lb. of resin, then add and stir in 3 tablespoonsful of plaster-of-Paris, and finally 1½ tablespoonsful of boiled linseed oil. The cement sets very quickly, and it must be applied hot. (11) Take 3 oz. of linseed oil, 4 oz. of tar, 1 lb. of resin, and melt together over a gentle fire. If too much oil is used, the cement will run. To obviate this, it should be tested before using by allowing a small quantity to cool under water; if not found sufficiently firm, allow it to simmer longer or add more tar and resin. The cement should be poured in the corners of the aquarium while warm (not hot). This cement is pliable, and is not poisonous.

Other Cements.—(12) Mix equal parts of flour of sulphur, pulverised sal-ammoniac, and iron filings, with good linseed oil varnish, and add enough white-lead to form a firm, easily worked cement. (13) Take 20 parts of clean river sand, 2 of litharge, and 1 of quicklime; mix into a thin putty with linseed oil. (14) Take 8 oz. of ordinary glue in solution, 1 oz. of Venice turpentine, and boil together, well stirring all the time until the mixture is complete. It will dry in two days. (15) Mix 6 parts of powdered graphite with 3 of slaked lime, 8 of sulphate of baryta, and 7 of linseed oil varnish. This mixture must be stirred to uniform consistency.

Securing Corners of Aquarium.—A good way of securing the corners of an aquarium is to use an angle-piece of zinc, and bed the glass in red-lead putty. If zinc cannot be used, butt the glass together, and make an angle inside with red-lead putty. On the outside angle fix with marine glue a piece of silk or other ribbon, stretching it tightly. The putty must be allowed to get quite hard before using the aquarium; otherwise there will be a leakage.

Rockwork for Aquarium.—A combination of coke and Portland cement can be made to serve as rockwork for an aquarium. The correct way to use them is to mix sufficient Portland cement, clean sharp river sand, and water to a thick batter. Into this dip the coke, and spike the pieces on iron skewers to dry them; this expedient allows them to be exposed on all sides to the air till thoroughly set and hard. Then make a second mixture of cement and give a second dipping. When the coating covers the surfaces completely—say $\frac{3}{8}$ in. thick—and is perfectly set and hard, the several parts may be dipped once more, the skewers removed, and the whole built up into the required shape on the bottom of the aquarium. Sprinkling the unset cement with pebbles gives a pretty effect. It must be left till hard and firm. Water should be poured in to cover it, and changed every day for a fortnight; or the lot put in a running brook for a week. Then put the shingle in at the bottom, anchor the plants, and fill up with water. If the plants grow and thrive, the fishes may be put in. Coke is unsuitable if not completely covered with an impervious cement.

Arsenic

Arsenic Bronze (*see* Aluminium, Blackening).

Tests for Arsenic.—The most important tests for arsenic are the Reinsch test and the Marsh test. For the first, the material supposed to contain arsenic should be in a fluid state; if solid, it should be made into a solution, in which the arsenic is soluble. To the solution concentrated hydrochloric acid and a small piece of thin copper foil are added, and the liquid is boiled for forty minutes. If there is no stain on the copper, the material is free from arsenic. If there is a stain, place the copper in a sublimation (thick glass) tube and heat gently; if arsenic is present, there will be a ring of minute octahedral crystals on the tube above the copper. For the Marsh test, a solution is prepared as above, and introduced into a hydrogen generator containing pure zinc, and pure sulphuric acid is then added. If arsenic is present, arseniuretted hydrogen is produced; and, by heating the delivery tube with a small flame, the arsenic compound is decomposed, a mirror of the element arsenic being formed on the tube just beyond the heat. The other wet tests are: To a solution add hydrochloric acid and then sulphuretted hydrogen; arsenic produces yellow precipitate of its sulphide. To another solution add ammonio-nitrate of silver; a yellow precipitate of silver arsenite will form. To another add ammonio-nitrate of copper, producing green precipitate of copper arsenite (Scheele's green). The dry tests are: Heat in a closed tube with sodium carbonate and potassium cyanide, producing a mirror of arsenic on the tube. Heat in an open tube, producing octahedral crystals of white arsenic on the tube. When heated before a blowpipe on charcoal, arsenic compounds give a white fume smelling like garlic.

Asbestos

Commercial asbestos includes two distinct minerals, which, though very similar in physical properties, are chemically distinct. One is a silicate of calcium and magnesium,

and is a variety of mineral amphibole. There are a large number of the non-aluminous varieties of amphibole which pass into fibrous minerals, especially tremolite and actinolite, and all these fibrous substances are included as asbestos. The other mineral that is sold as asbestos is a variety of serpentine, a hydrous magnesium silicate known as chrysolite. The first substance placed on the market as asbestos was the silicate of calcium and magnesium, or amphibole, but as the chrysolite began to be used for the same purposes, it was dealt with under the same name. These minerals resist equally heat or fire, but the chrysolite is superior in strength and elasticity of fibre, and is usually greenish-white, green, yellowish to brownish in colour, and has a decided silky lustre. The fibres are flexible, easily separated, and have a silk-like appearance. The mineral is usually found in seams, of varying thickness, in serpentine rocks. The amphibole asbestos is usually of longer fibre than the chrysolite, is very flexible, and easily separated by the fingers. It does not possess the silky lustre found in the latter, but has the appearance of flax, with a colour varying from white to greenish and woody-brown. One of the chief chemical differences between the two forms is that the amphibole variety is an anhydrous mineral, whereas the serpentine or chrysolite is hydrous, containing from 12 to 14 per cent. of water. Asbestos is brittle, but can be spun and woven.

Asbestos Composition.—For laying asbestos paste on a boiler and pipes, with the hand or with a piece of cloth or canvas rub some of the paste on the surfaces, leaving it quite rough so as to form a key for that which follows. The first coat is rubbed on to ensure the whole having actual contact and holding securely to the boiler. When the paste is dry, with a trowel apply the remainder in about ½-in. layers, leaving the surfaces rough (except the final one), and letting each coat dry before applying the next. It is customary to have the apparatus charged and the boiler and pipes quite hot when this is done. This opens the pores in the metal a trifle, and prevents cracking or shelling afterwards. More information is given under the heading "Pipe Coverings."

Asbestos Coverings on Gas-stove Reflectors.—These may get discoloured from the occasional smoking of the gas; they can be made clean and white again by simply sprinkling them with common table salt and starting the fire.

Asbestos Putty.—This can be made up of white-lead in oil, asbestos fibre, putty whiting, and boiled linseed oil. Just sufficient for use immediately is made at once. By using raw linseed oil instead of boiled oil, and keeping the putty in a tub, covering the upper surface to prevent contact with air, the putty can be kept in a workable state.

Asphaltum

Asphaltum is a naturally occurring mineral product; it is also known as bitumen or mineral pitch. It is black or brown, and glossy, easily fused, and more or less soluble in turpentine or benzol. It contains carbon, hydrogen, and oxygen. The pure forms of asphaltum are used in varnish making, while impure varieties are employed for paving purposes. It may be used for moulding, and may be rendered harder by incorporating with it lampblack, chalk, oxide of iron, etc.

Atlas

Binding Atlas.—The following instructions relate to binding an atlas and mounting the maps on guards. Before beginning to bind the atlas, it will be desirable to ascertain whether the publisher's cases will fit, as the guards will add to the breadth of the book. There are several methods of doing this work; but the following is easy, and will make a good job if carefully done. The best material for the guards is a thin close texture linen cambric, which should be cut carefully into strips about 1 in. broad and the full length of the maps, using a sharp knife and straightedge, so as not to have frayed edges. The strips should be folded lengthwise very carefully and straight. Assuming that the maps are all folded, take maps No. 1 and No. 2, and lay No. 1 upon the table with the back (or fourth page) uppermost; lay No. 2 on top of this, with the front (or first page) uppermost, the folded edge of No. 2 being about ½ in. from the edge of No. 1, and over them lay a piece

of folded paper ½ in. from the edge of No. 2. Then with the finger carefully paste the strips of the maps exposed. Thus both maps will have a strip of paste about ½ in.

Fig. 11.—Kent Axe Head.

wide along the fold. Now lift off No. 2 and lay it aside. Take the strip of linen, and lay it out on the table; then place No. 1 map down upon the linen about $\frac{1}{16}$ in. from the fold, rubbing it to make it adhere. Now take No. 2, and, having turned it over, lay it on the linen in the same way as No. 1. Thus two maps will be joined together with a linen guard, and as they lie on the table No. 1 will be at the left-hand side with the back uppermost, and No. 2 at the right-hand with the front uppermost, with the head or top farthest away from the operator. There should also be a space of about ¼ in.

Fig. 12.—Scotch Axe Head.

between the two maps. All the maps should be treated in the same manner, taking care to see that they are in proper sequence throughout. This will be quite strong enough; but, if desired, another strip of linen may be pasted between, the linen being pasted and laid down upon the two maps. After arranging all in proper order,

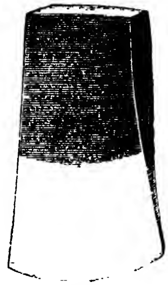

Fig. 13.—American Axe Head.

the book will be ready for sewing and binding. Of course, the edges should be cut before putting the book in the covers.

Autocopyist.

The following is a modification of the papyrograph. A sheet of fine paper is saturated with resinous varnish and then dried. Writing is done on this with a

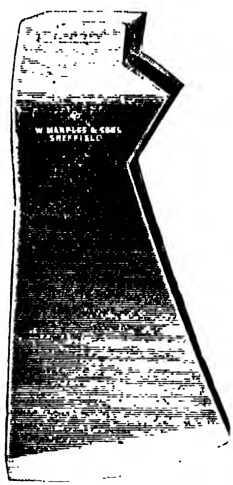

Fig. 14.—Kent Felling Axe Head.

strong solution of caustic soda. The soda converts the resinous varnish into soap writing. The paper is floated on water, written side up. When the water penetrates

the writing, the paper is dried between blotting-paper. Floating and blotting are repeated till the soap is all out of the paper. By fastening the paper over a flat surface covered with felt and saturated with printer's ink, a stencil is obtained which allows the ink to pass through the parts from which the varnish has been removed. Ordinary unsized writing paper pressed upon the stencil then takes the impression of the stencil. (2) On some hektograph composition (for the preparation of which see "Hektograph"), melted, but not overheated, in a shallow tray of sufficient size, float some sheets of stout blotting-paper. Write what is desired on glazed paper, using for ink a concentrated solution of alum, colouring the ink with any aniline, so that it can be more readily seen as writing. With a sponge, moisten one of the sheets of hekto-compo. paper, and partly dry it by using sheets of clean newspaper laid one after another flat on the moist surface, and peeling them off till they are found to stick with some firmness. Their adhesion shows the surface is dry enough. Then put on the alum-written sheet, with the writing side on the moistened hekto-compo. paper. Smoothing it softly and gently into perfect contact all over, leave it for about sixty seconds, then remove it. A printer's roller is then used with printer's ink to ink the writing. Copies are got by pressing paper on the inked writing. Each fresh copy requires the application of the inked roller.

Axes

An axe is a chopping tool fitted with a long handle, so as to be used with two hands, and swung like a sledge-hammer. Many types of axe heads are known ; Fig. 11 (p. 23) shows the Kent or English pattern, Fig. 12 the Scotch pattern, and Fig. 13 shows the American wedge-shape axe head. Fig. 14 shows the Kent felling axe head. The cutting edge is nearly always convex. For some work an axe with unequally inclined faces called a side-axe may be preferable, as for chopping projecting corners from a square log in preparing it for the lathe. The axe, being simply a wedge, is arranged to cleave rather than to cut the wood. In using an axe, the motions of the hands on the handle, which should be curved and oval in form, are similar to those of a workman on that of a sledge-hammer.

B

Babbit's Metal

The composition of Babbit's metal is:—4 parts copper, 8 parts zinc, and 96 parts tin. This metal is very suitable for machinery bearings.

Melting Babbit's Metal.—When melting Babbit's metal care must be taken not to overheat it, or the more easily melted constituents will partly evaporate, leaving the alloy in bad condition. Melt a small portion first, and gradually add to it until all is melted. Then skim off the top and the metal is ready to pour. Before pouring the metal, wrap a sheet of smooth writing paper around the shaft or other journal to be babbited, and secure it by winding a string spiral, in turns ½ in. apart. Then put in the bearing and pour the metal. The paper prevents the cold iron from too quickly chilling the babbit and gives it a smooth surface, while the grooves made by the string make good oil conduits. If this is properly done, the journals will fit the bearing nicely, and will not require scraping.

Balls (*see* Billiard, Golf, Tennis, etc.)

Bagatelle Table

Re-covering Bagatelle Table.—Remove the side slips and take off the old cloth, thoroughly clean off the old glue or anything that may cause the surface to be uneven, and remove the cups and clean round the sinkings. Lay the new cloth over the bed of the table, stretch it moderately tight, and cut to the shape required. Next make a pot of very hot French or Russian glue, and brush an even coat over the whole surface if the table is small; if the table is large a part is done at a time. The cloth is then laid on and brushed flat with a stiff clothes-brush, working from the centre and removing all puckers. With a sharp pocket-knife cut away the cloth over the cup sinkings, leaving ¼ in. inside the depression for the cups. Press the cups into position level with the surface of the cloth.

Baize

Fixing Baize on Card Table.—In fastening green baize to the centre of a card table top,

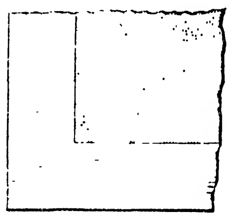

Fig. 15.

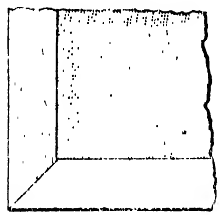

Fig. 17.

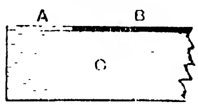

Fig. 16.

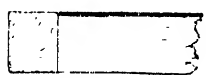

Fig. 18.

Figs. 15 and 16.—Plan and Cross Section, showing Veneer round Baize on Table Top.

Figs. 17 and 18.—Plan and Cross Section showing Good Method of Constructing Card Table Top.

in the event of the table top being made ready for the baize and no provision being made for the finishing of it, a veneer should be laid round the edge, the grain of which should follow the wood, as shown in Fig. 15. Fig. 16 shows a section, where A is the veneer, B the baize, and C the bed. A good method of making card tables such as are used for whist drives is shown in Figs. 17 and 18;

the bed of the table is of dry yellow pine or American whitewood, with an edging of walnut or mahogany fastened to the bed by means of panel pins, the mitres being glued.

Fixing Baize to Drawer Bottom.—Assuming that it is required to line the interior of a drawer, proceed as follows: Prepare some strong thick paste by boiling a mixture of flour and water, with a little powdered resin added; or get some bookbinders' paste, which contains dextrine and is very adhesive. Cut the baize slightly smaller than the drawer bottom, leaving a margin of about $\frac{1}{16}$ in. all round. Now lay the baize smooth side up (if a very rough baize is employed, its surface should be sponged with hot water and rolled flat with a ruler or any other cylindrical object that is handy) and spread the paste over the surface with a sponge; draw the sponge from one side of the baize to the other in straight and continuous strokes all in one direction until the whole surface is covered. Just enough paste should be left on to lay all the fibres, but not sufficient to soak through to the other side, or a stain will result. Next, with hot water, lightly sponge the drawer bottom and rub over it a little paste; lift the baize up by the two opposite edges, and, folding the dry surface inwards, lower the loop on to the middle of the bottom of the drawer; then spread the baize out flat in each direction with the hand. When the baize is arranged in position, with the roller roll out from the middle towards the edges, using a piece of rag to pick up the paste that is squeezed out. Then press in with the thumb a tintack at each corner to help in keeping the baize down whilst the paste is drying. The baize should not be touched until dry, which may take from one to three days, according to the weather. Thin glue applied very hot may also be used in like manner, and will dry quicker, but is much more difficult to manage.

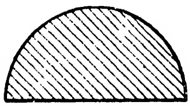

Fig. 19.—Section of Bamboo Worker's Rasp.

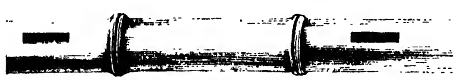

Fig. 20.—Mortice Holes in Bamboo.

Fixing Baize in Violin Cases.—A warm shop and good glue are requisite. For a soft lining, cut out stout brown paper to fit the case; on it lay a sheet of wadding, cut $\frac{1}{2}$ in. smaller all round than the paper. Cut the baize or cloth larger than the paper so as to turn over the edge. Lay the paper with its wadding upon the baize, wadding downwards; glue round the edge of paper and fold the baize over the edge. The glue must be rather thicker than for woodwork, but must be used sparingly. If wadding is not desired, decide whether the bottom or sides of the case shall be done first; if the bottom, cut it a little larger, say $\frac{1}{4}$ in. all round. Glue the wood, not the baize, and take care that the edges are well glued, but that there are no superfluous puddles. Place the baize in position and gently rub from the middle towards the edges; this must be done quickly and without undue pressure; a bone folder or paper-knife rubbed along the angle will make all close. If there is too much margin, cut off with a sharp knife about $\frac{1}{4}$ in. up the sides. The sides may be lined in the same way; the part being glued should be horizontal. Baize for the sides should have the bottom edge cut true with knife and straightedge; then adjust in the

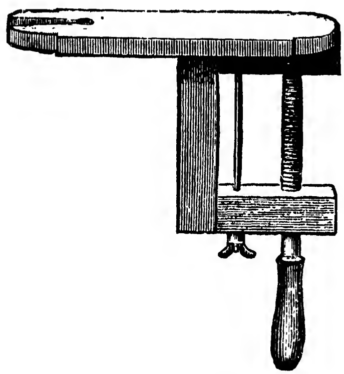

Fig. 21.—Fret Worker's and Bamboo Worker's Cramp and Table.

angle and stroke upwards. Generally, any superfluous baize at the top can easily be cut off with knife or scissors if it is glued up to the edge.

Marking Lines on Green Baize.—For marking permanent white lines on the green baize of a small game board a material must be used which will not impede in any way the progress of a ball. If some white is mixed thinly in turpentine, so that it will sink into the baize and not lie just on the top, no resistance would be offered to a ball crossing the baize. Rub up some white-lead in a little varnish stiffly, and then thin with

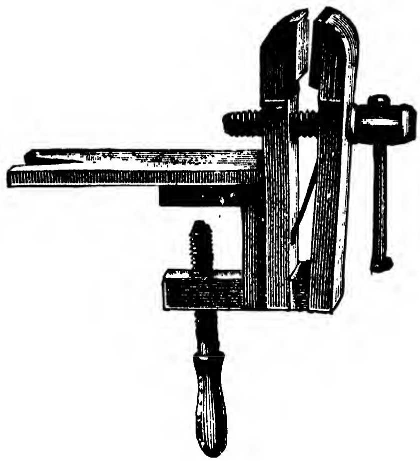

Fig. 22.—Fret Worker's and Bamboo Worker's Cramp and Table with Vice.

turpentine. The lines might be drawn with a small lining fitch and straightedge. When they are thoroughly dry, rub the baize over with a clothes-brush.

Bamboo

Bamboo Worker's Tools. These consist of hammer, pincers, screwdriver, tenon saw, bradawls, and, in short, of such wood-working tools as the handyman usually possesses, with the addition of a very few special ones. Special rasps, of sharper curve than ordinary ones, are used (see the section, Fig. 19) for hollowing out the ends of bamboo canes. The requisite curve could not be obtained by using a knife. Bamboo rasps are made in all sizes from $\frac{1}{2}$ in. to $1\frac{1}{4}$ in., the most useful being $\frac{1}{2}$ in., $\frac{3}{4}$ in., and 1 in. Bamboo workers generally use a separate rasp for each size cane, as it saves time, but a 1-in. rasp will do all the work necessary; at the same time, as rasps

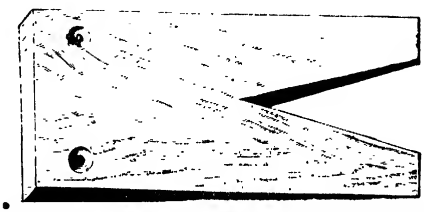

Fig. 23.—Bench-board used in Bamboo Working.

are not very expensive, a $\frac{3}{4}$-in. rasp can be bought, and it will be very useful. A brace and a supply of drills will be necessary, because every nail that is driven into bamboo must have a hole made to receive it, or the bamboo will split. In many cases a long bradawl is a suitable tool with which to make the hole, but often the brace and bit are necessary; the latter tools also are useful in cutting dowel or mortice holes (Fig. 20); the hole is started by drilling, and then is finished with the chisel, small file, or knife. Of course, a supply of bits to be used with the brace will be required. A handy appliance for the bamboo worker is a fret worker's wooden cramp and table (Fig. 21) When this appliance has a vice affixed to it, as in Fig. 22, it is perhaps still

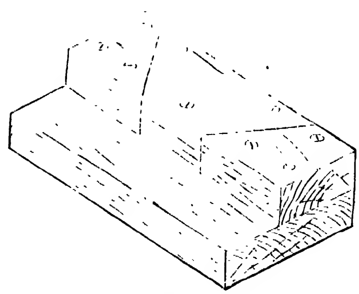

Fig 24.—Mitre Block.

handier. The cramp is fixed to an ordinary bench or table easily, and forms a most convenient work-table. A cramp and table not having a vice may be obtained in two sizes, the larger size usually having a table

measuring $10\frac{1}{2}$ in. by $4\frac{1}{2}$ in.; but probably it will serve the bamboo worker's purpose the better to construct such an appliance slightly larger than the one mentioned. A board, cut as shown by Fig. 23, will be useful in rasping the ends of the canes; it should be fixed so that the vee projects beyond the edge of the bench. This board is not necessary if either of the fretworking appliances (Figs. 21 and 22) is obtained. A mitre block or a mitre box will be necessary when making joints at right angles. The uneven bamboo may be rather difficult to hold true and steady on the block, but the difficulty is not so great in the mitre box, where the sides are of great assistance. An ordinary mitre block is illustrated by Fig. 24.

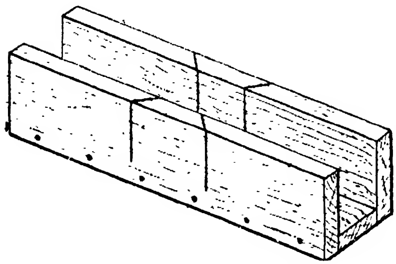

Fig. 25.—Mitre Box.

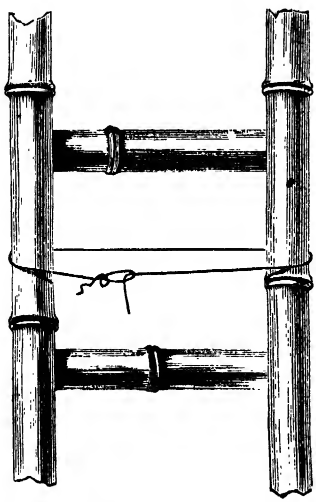

Fig. 26.—Method of Cramping Joints in Bamboo Work.

To make it, a piece of deal, measuring $1\frac{1}{2}$ in. by 3 in., is screwed down to a piece measuring $1\frac{1}{2}$ in. by 6 in.; both of the pieces are about 18 in. long. Then the mitre cuts at angles of 45° to the long edges are made with the saw, with which the bamboo is to be cut. The mitre box (Fig. 25) has sides 4 in. high, the strip screwed between them at the bottom being $2\frac{1}{4}$ in. wide; thus the usual sizes of bamboo canes up to 2 in. or so can be accommodated. The three pieces of wood used in making the mitre box are each $\frac{3}{4}$ in. thick and 18 in. long. The mitre cuts are made as in the mitre block above. If canes of larger diameter than 2 in. are to be used, the width of the mitre box must be increased accordingly. Clamps will be needed to hold together freshly glued and dowelled joints; but a good substitute for a clamp can be formed with a piece of string. As is shown in Fig. 26, the string is tied loosely round the pieces of bamboo to be held together, and then the string is tightened by twisting, a stick being inserted for this purpose. If the stick is made just short enough to revolve in the available space, the tightened string can be prevented from untwisting by

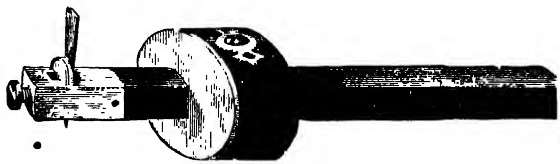

Fig. 27.—Cutting Gauge.

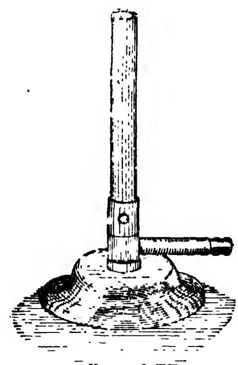

Fig. 28.—Bunsen Burner.

gently pushing the stick through the string so that one of its ends rests on one of the bamboo crosspieces. For cutting strips from bamboo canes, or for making grooves, a cutting gauge (Fig. 27) will come in useful.

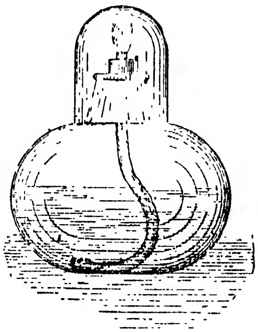

Fig. 29.—Spirit Lamp.

The tenon saw used has fine teeth, and should be kept well sharpened and set, the skin of bamboo being particularly hard. Any other special tools or appliances required are those for use chiefly in bending bamboo.

Bending Bamboos: Appliances.—Bamboos are bent principally by heating them in a smokeless flame, the heat rendering them pliable, so that they can be bent without much difficulty, the shape given being retained when cold. Either a Bunsen burner, if gas is available, or a large spirit lamp should be obtained, though any device that gives a fairly large but smokeless flame is suitable. A plumber's benzoline blow-

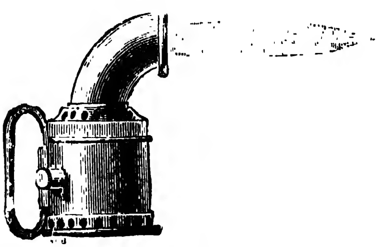

Fig. 30.—Benzoline Blow-lamp.

lamp answers admirably. The Bunsen burner (Fig. 28) will have to be bought, probably, as will also the spirit lamp (Fig. 29); though a very good spirit lamp, more efficient for bamboo working than is the bought article, on account of its larger flame, can be made at home at hardly any cost. Fit a piece of bamboo, about 5 in. or 6 in. long, into the neck of a stone ginger beer bottle, and pass a wick composed of loose

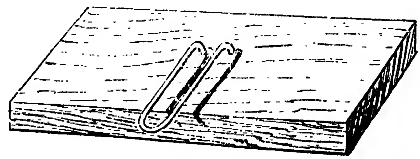

Fig. 31.—Bamboo Bending Iron in Block.

cotton threads through the bamboo tube; when the bottle has been half filled with methylated spirit, the lamp is ready for use. The Bunsen burner is the best possible thing for heating, only the heat must not be concentrated too much to one part, but the burner kept continually on the move. A substitute for a spirit lamp or Bunsen burner is a composite candle, well wrapped round with paper from top to bottom; this, when lighted, gives a good flame, although rather smoky; but with care bamboo may be bent very well with it. If a benzoline blow-lamp is used, it should be of simple design; that shown in Fig. 30 is as good as any for the purpose, owing to its simplicity. Benzoline and spirit lamps, however, should be used only when there is not a gas supply, the Bunsen burner being much the best heating appliance. A bending iron is necessary, and may be merely a piece of thick iron wire, bent as in Fig. 31, and fixed in a bench or plank; but the iron shown by Fig. 32 is better; this is made of $\frac{3}{8}$-in. rod, the ends being flattened out, bent, and fixed in the bench as in Fig. 33. The iron

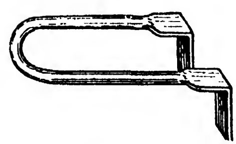

Fig. 32.—Bending Iron for Bamboos.

loop measures 2 in. across the inside, and is from 5 in. to 7 in. long, though the size may be increased or decreased according to the size of the bamboo to be bent. A bending board can be used instead of an iron; it is

made with a fret-cutting board (see Fig. 23) by screwing on two strips s (Fig. 34). These strips should be of tough wood, rounded a little in the middle, about 1 in. thick, $1\frac{1}{2}$ in. wide, and as long as the board is wide.

Bending Bamboos : The Method.—To bend bamboo, pass the end of the cane through the loop of the bending-iron and underneath the top of the bench (Fig. 33), and with the outside end of the cane in one hand, and the Bunsen burner or other heating appliance in the other, bend the cane by a gentle downward pressure, while the part of its surface that is to form the inner curve is made hot by allowing the flame to play upon it as it is passed slowly up and down (see Fig. 33). Do not concentrate the heat, but move the flame about so that the cane is not burnt. When the cane is sufficiently pliable, a gentle pressure should be able to produce the required curve ; then a wet cloth should be rubbed up and down the cane till it is cold, keeping the cane in the bending iron and continuing the downward pressure. Canes that have been exposed very long to the weather, or that are old, can seldom be bent satisfactorily. Fresh, new canes, as just imported, bend the best. When a sharp bend is required, it will be better to cool down as above described when it is bent to half the requisite curve, and resume the heating and bending after sufficient time has been allowed for the cane to cool. A cane that is bent too quickly is liable to split. When heating preparatory to bending, take care not to burn the canes ; rotating them will prevent this. It is best to make the bend on a part of the bamboo between the knots. But if there must be a knot where the bend is required, rasp the knot flat on the side that will form the inside of the bend, and (excepting in very thin canes) notch on the same side with a saw about a quarter through. In any case, it will assist the bending operations if a few very slight saw cuts are made on the inner part of the cane required to be bent. This prevents the surface of the cane breaking away. It is not quite possible to prevent a certain amount of flattening at the bend ; but this can be remedied to a great extent by using a mallet judiciously when the bend is thoroughly set, and the inner parts, where joined on to other parts, may be slightly rasped to restore the requisite

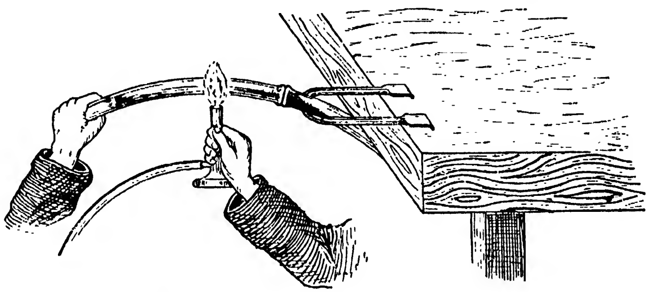

Fig. 33.—Method of Bending Bamboo.

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roundness. If a bend is made too acute, it can be opened out by heating in the flame and pulling apart in the hands, or in the bending hook. It is not possible to bend a bamboo cane to a very acute angle without cutting out a V-shaped piece to allow for the reduced length of the inner as compared with the outer side of the cane. A slight bend is all that can be made if the cane is to be uninjured or uncut. The bending must be done very gradually. It is better to go by easy stages if the cane is very large, hard or tough. Of course, very large and thick canes can scarcely be bent at all. Canes stouter than $1\frac{1}{4}$ in. or $1\frac{3}{8}$ in. cannot be bent satisfactorily ; here, joints must be made to serve the purpose.

Bending Bamboos : Difficulties.—The beginner probably will split many canes in his early attempts at bending. This is due, perhaps, to too much heat, and consequent burning, or to insufficient heat, in which case the cane does not become pliable

enough. Or perhaps the cane has been bent too quickly; a usual fault is that the heat is concentrated too much. A safe plan is to apply heat over a considerable surface and keep the burner constantly on the move; then, with one hand holding the end of the cane, by putting on the pressure gradually the cane will give slightly. Occasionally wipe the heated part with a wet rag, still keeping the cane bent; then apply more heat and again the wet rag, and so on until the required bend is obtained.

Bending Bamboos into Scrolls.—Cane $\frac{3}{8}$ in. in diameter may be bent into small scrolls in the following manner. Soak the cane in water for twelve or more hours, and then hold over a Bunsen flame. When supple, wrap the cane round a peg of the size wished, and tie it there till cold.

Bending Bamboos to Uniform Curve.—When bamboos are to be bent to a uniform curve, bend the first piece to the required

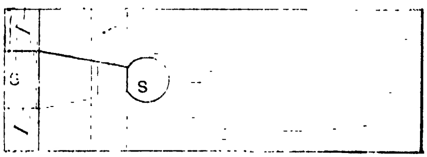


Fig. 34.—**Bending Board for Bamboo.**

shape and use it as a pattern, the other bends being tested by it. Or make a template block to the shape. If a complex bend is required, a drawing is often made on a piece of wood or paper, and the bend applied to the drawing as the work proceeds.

Bendtng Bamboos with Hot Water and Steam.—It is difficult to bend bamboo by the usual method without the flame marking it; but a method which answers when the canes must not be marked is to soak them in boiling water, and whilst hot to bend them as required. When cold the cane will permanently have assumed the shape given it. Bamboo canes may be rendered sufficiently supple for being bent by steaming; the time taken to soften the bamboo can be shortened by employing superheated steam. The bamboo is placed in the steaming apparatus, the lid screwed close, and the steam turned on. When the bamboo is softened, the steam is turned off; directly the bamboo is removed from the steam, it must be bent, and held so until cold.

Bending Bamboos without Bending Iron.—Many professional bamboo workers, instead

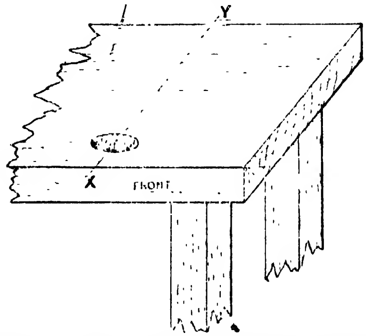


Fig. 35.—**Part of Bamboo Worker's Bench.**

of using a bending iron, have a 2-in. hole, as shown in Fig. 35, bored slantingly through a very strong bench; the inclination of the hole is shown by Fig. 36, which is a section on line X Y (Fig. 35). The cane to be bent is inserted in the hole and treated as usual. This is claimed to be the best method of bending, as when using a bending iron there is a liability of this getting too hot, and so marking the cane. The cane to be bent should be heavy, though not more than $1\frac{3}{8}$ in. in diameter, as the more substantial are less liable to bulge or split than the lighter ones.

Boring Holes in Bamboo.—Ordinary centre-bits may be used for boring holes in bamboo

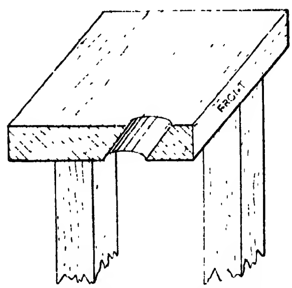


Fig. 36.—**Section of Bamboo Worker's Bench.**

canes where the holes are small in comparison with the cane in which they are to be made. But as the hole to be bored approaches, in diameter, to the thickness of the cane itself,

centre-bits work less and less satisfactorily, unless the hollow middle of the pole is filled with wood, and this, of course, is only possible near the ends of the cane. Bamboo workers get over the difficulty by the use of a bit

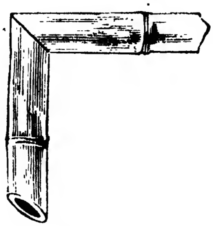


Fig. 37.—Mitre Joint in Bamboo.

specially modified for bamboo fitting. A twist screw-bit of Jennings' pattern (see Fig. 112, p. 86) is obtained, and the threaded centre-point of the bit is filed down to a triangular-pointed shape. This is done because the unaltered bit feeds itself too rapidly and invariably splits the work; but with a plain triangular point the feed depends upon the pressure applied. Even then the centre-point is apt sometimes to start a split, and in very particular work the precaution should be taken of boring a bradawl hole first, especially when a large hole has to be made near the end of a cane.

Colouring Bamboo.—Light canes are darkened by scorching them in the flame of a Bunsen burner or spirit lamp. Another way is to coat them with ordinary enamel paint. To brighten the colour, a hard varnish is used diluted with an equal bulk of methylated spirit. Bamboo will not take stain or dye as does ordinary wood, so any colour that cannot be obtained by scorching the cane must be applied in the form of coloured varnish. Bamboo furniture when made up is coloured by applying suitable

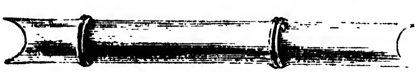


Fig. 38.—Hollowed Ends of Bamboo.

pigments, as vandyke brown, brown umber, or black mixed with French polish or spirit varnish thinned out with methylated spirit, finishing with clear varnish. Light coloured canes that have been stored in a damp place to render them soft may be stained brown with a mixture of vandyke brown and American potash in hot water.

Fillings and Stoppings for Bamboo.—Bad joints in bamboo work can be filled in with

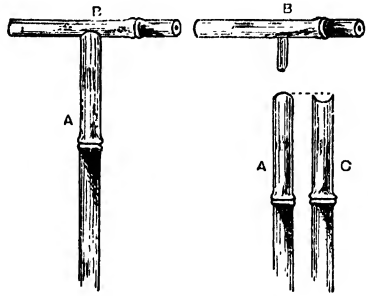


Fig. 39.—T-joints in Bamboo.

a mixture of sawdust and hot glue made to the consistency of thin paste, all surplus paste being cleaned off before it dries. Cracks in bamboo canes can be filled with shoemakers' heelball. A lighted taper is applied to the heelball, and sufficient allowed to drop into the flaw. After it has set, rub with a clean cloth until the surface is perfectly level. Another mixture for filling in bad joints is one made by melting equal parts of resin and beeswax in an old ladle or spoon; yellow ochre or umber is added to match the colour of the bamboo. Press the composition well in with a piece of wood, and clean off when cold with a

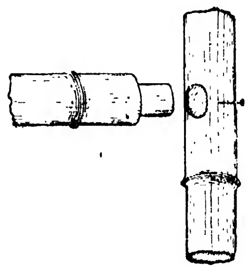


Fig. 40.—T-joint in Bamboo.

sharp knife or chisel. Touch up afterwards with transparent spirit varnish. A filling for screw holes in bamboo is plaster-of-Paris, mixed with water and applied immediately it is made. When dry it can be

glasspapered smooth and coloured with dragon's blood, gamboge, etc.; or ochres and umbers can be mixed with the wet plaster to give the desired tints.

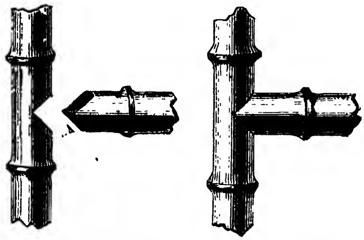


Fig. 41.—Notched T-joint in Bamboo.

Jointing Bamboos.—The joints used in bamboo work are only a few in number. For joining the ends of two canes together at right angles, in all cases a mitred joint is the most satisfactory and easiest in working, and should be adopted wherever practicable, leaving the bends for flowing lines and curves. In forming a mitred joint, the ends of the two canes are plugged with pieces of wood which are glued in. When the glue is quite hard, the mitres are cut on a mitre block or in a mitre box with a tenon saw, and the two sawn surfaces then are placed together, glued, and further secured by fine nails or brads, in the way shown by Fig. 37. When a piece of bamboo is to be joined to another piece at right angles to form a T, the end of one piece is rasped out to fit the curvature of the other

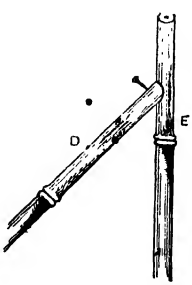


Fig. 42.—Angle Joint in Bamboo.

(see Fig. 38). Either before or after rasping, the end is plugged. In this case the two pieces are held together merely by a nail passing through one cane into the plugged end of the other. Fig. 39 shows a better method of making such a joint. The hole at the end of A is smoothed 2 in. or 3 in. deep to receive the dowel fixed in B, after which the end is rasped out as shown at C, so that it fits evenly on B. Glue should be used to make the joint secure. Another method, but one, however, which practically is the same as the last, is to drill a hole in the side of one piece, and to insert in this the plugged end of the other; secure with a wire nail (see Fig. 40). The best wood for dowels is straight-grained deal; this is sawn into long, square strips, and cut up into the special short lengths required, being shaped to fit the hollow canes by means of a knife, plane, or chisel. Another method of forming a T-joint is shown in

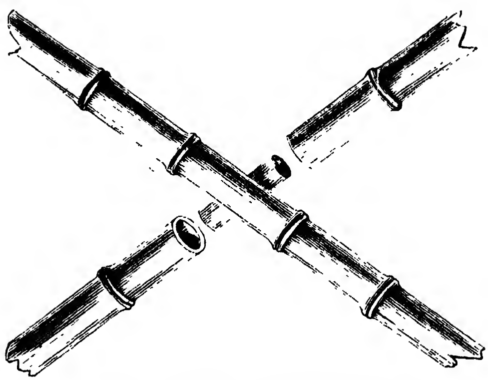


Fig. 43.—Diagonal Joint in Bamboo.

Fig. 41. The end of one piece is plugged and cut V-shape as shown. A V-piece is cut in the other, and the joint made with glue and a fine nail. Pieces joining at an angle other than a right angle are illustrated by Fig. 42. Cut the end of the cane D to the proper angle, plug it with a piece of wood, and then round it off with the rasp so that it fits evenly against the cane E. At the connecting point glasspaper the varnish off the vertical bamboo rod, the glue holding better when the cane is thus roughened. The joint can be further strengthened by means of a nail or screw, as shown. Fig. 43 illustrates the joint of diagonal pieces. This is made in much the same way as described for the joint illustrated by Fig. 39, the ends of the two shorter rods being

bored to receive the ends of the dowel, which passes quite through the longer cane, a hole having been bored to receive it. Lengths of bamboo are jointed one to the other in a straight line, either by glued plugs or by brass ferrules. In joining two

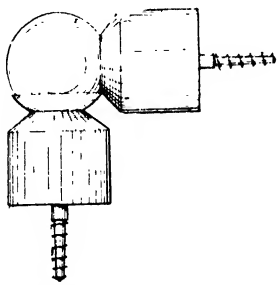


Fig. 44.—Bamboo Bay-pole Joint.

lengths at an angle it is better to cut off one piece at the knot, as any difference in the thickness can then easily be rasped off. The bay-pole joint shown by Fig. 44 saves a lot of trouble in such a case. It is really a cup-and-ball joint, and is made of wood, coloured to imitate bamboo; at each end is an iron screw (wood thread), and all that has to be done when forming the joint is to cut the bamboo the requisite length allowing for the joint, plug the ends with wood, and screw the joint into them. They not only make the bay-pole strong where the weakest point generally is, but no template is required, as these joints adjust themselves to any angle.

Mottling Bamboo.—Yellow bamboo cane is mottled or marked by burning at frequent intervals with a Bunsen burner, or by partly covering the cane with a thin paste of whiting and water, and then passing the cane through a flame, afterwards removing the whiting. The paste protects the covered parts from burning. Tortoiseshell bamboo canes are so cheap, however, that it does not pay to mottle the yellow ones.

Rebating Bamboo.—In running a rebate in a bamboo cane an ordinary rebate plane may be used. The principal difficulty, however, will be in the holding of the material while using the plane; but this can be overcome by proceeding as follows:—Secure a few little blocks to the bench on each side of the cane as at AA (Fig. 45), screw a lath, having one edge straightened, on to the blocks, to press tightly on the top of the cane, as at B. The edge of this will form a guide for the rebate plane C, and will enable the worker easily to clean out the portion shown in black on Fig. 45. If the rebate groove is to be "stopped" within a few inches of each end, it may be cleaned out with a chisel, and finished with a router, or "old woman's tooth plane," using the lath B in this case as a guide for both width and depth.

Some Examples of Bamboo Work.—A range of designs for furniture must be looked for elsewhere, but to illustrate the application of the bends and joints already described two pieces of furniture of quite a simple nature will be discussed. Fig. 46 shows a design for a bamboo gipsy table. These tables, which may be round, hexagonal, or octagonal in shape, are generally made with a top of 1 ft. 6 in. diameter. The average height of the finished table is 2 ft. 4 in. For the legs, cut three pieces of 1½-in. diameter bamboo 2 ft. 10 in. long. Holes must be bored in these with a ⅝-in. bit 6 in. from the heaviest end. The grec (see Fig. 47) is composed of three pieces of ¾-in. bamboo 11 in. long, which are jointed

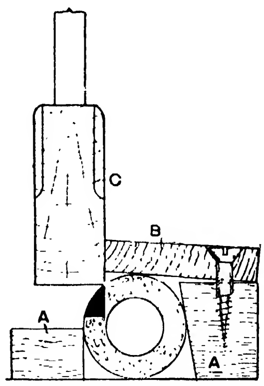


Fig. 45.—Method of Rebating Bamboo.

together to form a triangle measuring 5 in. from corner to corner, the joints being made by shaping one end of each piece to fit, plugging with wood, and fixing with glue and a long wire nail. The free ends must be pared to fit loosely in the legs, and it will

be necessary to enlarge the holes to an oval shape so as to allow the legs to cross each other at a point 1 ft. 8 in. from the foot ends. At this point the legs are screwed together by holding them firmly with the left hand and boring with a quill bit, to receive $1\frac{3}{4}$-in. japanned round-head screws. The legs are cut slantwise to fit the top, using a piece of stick as a gauge from the floor, resting the saw blade horizontally on the top end whilst cutting. The stand is then placed evenly on the top and fixed with screws (see Fig. 48). The gauge stick

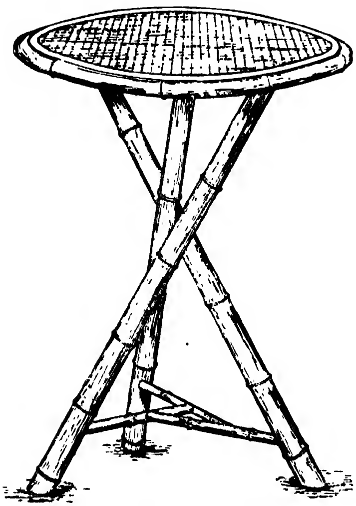


Fig. 46.—Bamboo Gipsy Table.

is again used in cutting the feet to fit the floor, to ensure the table standing upright and level. If screws are objected to where the legs cross, an invisible joint can be made by connecting the legs at the touching points with $\frac{3}{8}$-in. beech dowels, glued in. This method is employed with the better class of gipsy tables. The tops are usually covered with matting, and hooped and beaded with split cane. The cake stand shown in Fig. 49 is of simple construction, designed specially to suit beginners in bamboo work. Fig. 50 is a side elevation of the stand with the handle dropped back, and gives the necessary dimensions. Three circular trays are required, $10\frac{1}{2}$ in. in diameter, cut from $\frac{1}{2}$-in. deal board. The wood should be quite dry, to keep the trays from warping out of shape; the wood also cuts much better with the bow-saw when perfectly dry. One side of the circular trays should be planed, the upper surface being covered with plain Chinese matting, glued on; this will stick better if the wood is roughened by scraping over with a rasp or the teeth of the saw. The timber will probably be slightly hollow on one side, so it is more convenient to plane the round side. The glue is applied on the hollow side of the board, and the matting laid on across the grain, after which they should be placed under a weight to set. This will ensure them being quite straight. The legs are of 1-in. diameter bamboo, slightly curved at the

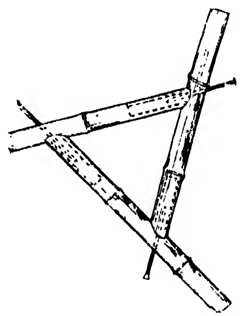


Fig. 47.—Grec or Braces of Bamboo Table.

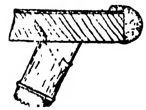


Fig. 48.—Fixing Top of Bamboo Table to Legs.

bottom. They are cut at the other end to the required length. Two bradawls will now be necessary, for 1-in. and 2-in. panel pins. A panel pin is used to pierce the legs before boring the holes for the screws that secure the trays. A sharp quill bit is used for boring the holes, the brace being turned rapidly and without too much pressure. The holes must be in perfect line with each other. The two side legs are also bored for a spindle of $\frac{1}{2}$-in. bamboo, which is let in direct 6 in. from the floor. These holes are made by first piercing, then boring out with a $\frac{1}{2}$-in. centre-bit. By first taking a few turns backwards, the bit will so scribe the bamboo as to prevent splitting. It is advisable for beginners to practise boring on a waste piece of material. The back and front legs are bored for the spindle running directly below the other. Now the trays should be trimmed, and hooped with split

cane $\frac{5}{8}$ in. thick, fixed with 1-in. panel pins. The side legs are then screwed on with 2-in. japanned round-head screws, allowing the grain of the wood to run from back to front. The ends of the spindle should be rasped and glued in at the same time. The back and front legs are fixed in the same way. The spindles are screwed together where they cross, as shown at A in Fig. 51, which also shows the corner pieces of thin bamboo under the lower tray. Fig. 52 gives an

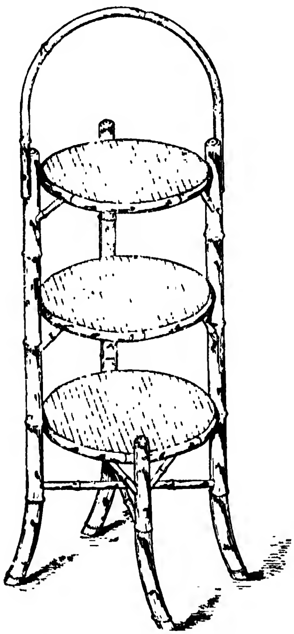


Fig. 49.—Bamboo Cake Stand.

underneath view of these corner pieces. Similar pieces are put on the front of the side legs. The ends of these pieces must be rasped to fit the surface of the legs, and fixed with glue and panel pins; and the legs must be roughened with a rasp where the pieces are attached, or the glue will not hold. The top ends of the legs are plugged and finished with terminals of turned wood. For the handle, a piece of cane is required 3 ft. long by $\frac{1}{2}$ in. thick; this will bend to the shape quite readily on being heated. It is cut to the required length and bored at the ends, being fixed by removing the top side screws and substituting longer ones (see Fig. 53). One coat of brown hard spirit varnish applied in a warm room will give the necessary finish.

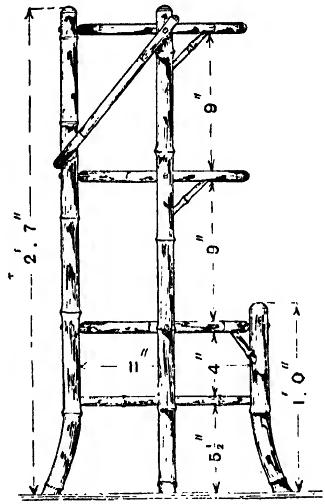
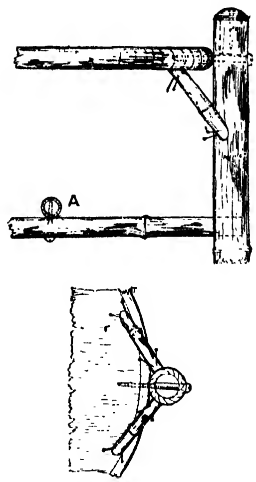


Fig. 50.—Side View of Bamboo Cake Stand, Handle Down.

Straightening Bamboos.—Canes may be straightened in the same way that they are



Figs. 51 and 52.—Details of Construction at Lowest Shelf of Bamboo Cake Stand.

bent; a convenient tool for straightening bamboo is a piece of deal about 2 in. square and about 16 in. long, with a square groove,

$1\frac{1}{2}$ in. wide and 1 in. deep, cut obliquely across one of its sides (Fig. 54). The cane to be straightened must first be made hot in the flame of a Bunsen burner, then laid in the groove, by which it will be gripped, while the wooden tool is used as a lever to straighten it.

Banjo

Cleaning Banjo Vellum.—Take off the strings, and scrub the skin gently with a nail-brush, almost dry, using a very little good quality soap, and finally a slightly damp

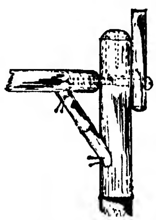


Fig. 53.—Elevation showing Construction at Top Shelf of Bamboo Cake Stand.

sponge. This will, of course, slacken the skin a little, but on drying it will resume its former tightness. Another way to clean dirty vellum is to use a piece of flannel wrung out in tepid water, and ordinary soap, but if the vellum is very dirty, a little Monkey Brand or Pynka soap may be used with advantage. The principal thing is to use as little water and soap as possible. After the vellum is cleaned, slacken the screws slightly, and tighten up again as the vellum dries. If the head is a good one, this should prevent splitting; but if, on the contrary, the head is old and much worn, there is always a possibility of splitting. To remove grease, benzine may be very sparingly used, but it is not so cleansing as the former process. If the head is stained and discoloured quite through, there is nothing that will entirely remove the stains (*see also* Vellum).

Banner

Repairing Silk Banner.—In repairing a silk-lined banner that is torn in one or two places, first remove the lining to get at the torn part, then lay the banner face downwards on a level surface. Obtain some strong thin silk ribbon about $1\frac{1}{2}$ in. wide and cut it into lengths, say 2 in. longer each way than the slit in the banner. Place the edges of the slit carefully together and glue on the ribbon with indiarubber solution; stretch the ribbon flat, and lay on it a heavy flat weight till dry.

Barbedienne (*see* Bronzing)

Barometer

Aneroid Barometer.—A barometer measures the pressure of the atmosphere. In the aneroid barometer this is done by noting the depression of the lid caused by the unbalanced pressure of the atmosphere upon a box from which the air has been removed. The barometer is usually somewhat drum-shape, thin corrugated sheet steel discs forming the membranes of the drum. A membrane carries at its centre a spring, and the slight variations in this, caused by the depressions of the disc, are magnified by suitable mechanism, so as to be easily readable on a dial. This form of instrument is not usually as accurate as the mercury barometer.

Aneroid Barometer, Cleaning.—When taking an aneroid barometer to pieces, first remove the pointer, which, like the hands of a clock, is merely pressed on its arbor. Then remove the dial. It will now be seen that to the mainspring (which, acting in opposition to the vacuum chamber, gives rise to the variations of the needle in the

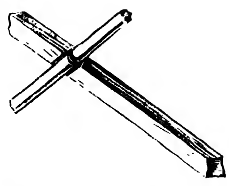


Fig. 54.—Method of Straightening Bamboo.

instrument) is attached the main lever and a system of smaller levers and springs. It will be necessary to remove these next. First release the regulator of the movement, which works between centres supported by the bent ends of a small base-plate. Next detach the fine steel rod which connects the regulator with the main lever. Then unscrew

the main lever from the mainspring. The arbor which carries the regulator carries also a bent-up arm to which is attached a fine chain. Release this chain and remove the arbor by unscrewing the centre ends. Now unscrew the projecting arm from the pillar to which it is secured, and remove the thin brass plate which is screwed to the small brass pillars at the end of the projecting arm. By doing this the arbor which carries the hairspring and the chain can be removed. The base-plate of the movement can then be removed. Now take off the knife edge which fastens the mainspring to the upper part of the vacuum chamber, and then unscrew the iron carriage which supports the mainspring and which is fastened to the foundation plate. Finally, unscrew the vacuum chamber from its position on the foundation plate. Having thus taken the whole instrument to pieces and placed the parts separately and systematically to hand, it will be easy to see where they belong and to clean them consecutively. Place the rusted steel and iron parts in a basin filled with paraffin oil. Let them soak for awhile, and then rub them free of rust. Brush the chain with rather a hard tooth-brush and examine each link to see that no material damage has been done. If the links are sound, well and good; if not, a new chain may be required. Similarly with the springs and the pointer. The latter is of aluminium, and will require gentle handling. When all the parts have been cleaned and dried, rub them over with clean tallow and fix them again in their respective places. If, when removing, close observation has been made as to the relative positions of screws and levers, and the pieces are returned as nearly as possible to their places previous to removal, much time and trouble may be saved in the matter of regulating the instrument. When the instrument has been put together and screwed into its case, it must be tested under an air pump to ascertain whether there is any alteration in its range—that is, in the number of inches indicated on the dial. If this test is unsatisfactory, another dial should be obtained and divided to suit. When this has been divided and engraved, and placed in position, the pointer is attached to the arbor. Then the portion of the scale to which it should point is ascertained by reference to the scale of a standard mercurial barometer. By a slight turn of the adjusting screw connected with the carriage which supports the main spring, exact agreement is obtained. Finally, the aneroid must be tested under various pressures with a standard mercurial barometer. In testing, both instruments are placed in receivers connected by a tube and stopcock, thus virtually forming one chamber. When the compartments are simultaneously exhausted of air, if the scale of the aneroid has been rightly divided and the instrument works in accord with these divisions, the pressure in inches indicated will correspond, tenth for tenth, with the divisions on the mercurial scale as the mercury falls and rises. Lastly, it must be remembered that, however well the instrument may have stood all the tests, any form of aneroid will require occasional adjustment, which must be done by means of the adjusting screw and comparison with a standard mercurial barometer. In many aneroids one of the short levers, which form a part of the general arrangement for magnifying the movements of the sides of the vacuum chamber, has a means of lengthening or shortening its leverage for the express purpose of adjusting the movements of the index hand to the graduations of the dial—that is to say, to bring the indications inch for inch to correspond with those of a mercurial barometer. The comparison of an aneroid with a mercurial barometer under varied pressures requires a special apparatus, and causes the handling of aneroid barometers for cleaning and adjustment to be the special business of an instrument maker.

Camphor Barometer.—The weather glass in which camphor is used is not at all a good one, because it merely records to some extent the changes of temperature, and not the pressure of the atmosphere. A glass may be made by dissolving 2 pts. of camphor in the least possible amount of spirit of wine or methylated spirit at the temperature of the room it is wished to keep it in. Now add 1 part of nitre and 1 part of chloride of ammonia, then water in small portions at a time until crystals appear very faintly. Shake up, and fill the tube with this. When

the crystals have settled to the bottom, the day being fine and warm, make a mark on the index, and label it *fine;* when the day is cold and wet, the crystals will increase in number and fill a greater part of the tube, so make another mark, and label *wet or rain;* then an intermediate mark will be *change*, and so on. But the device is not reliable. The following is another method: use camphor, 2½ drachms; alcohol, 11 drachms; water, 9 drachms; saltpetre, 38 grains; sal-ammoniac, 38 grains. Dissolve the camphor in the alcohol and the salts in the water, and mix the solutions together. Pour into test tubes, cover with wax after corking, and make a hole through the cork with a red-hot needle, or draw out the tube until only a pin-hole remains. When the camphor, etc., appears soft and powdery, and almost filling the tube, rain with south or south-west winds may be expected; when crystalline, north, north-east, or north-west winds, with fine weather, may be expected; when a portion crystallises on one side of the tube, wind may be expected from that direction. Fine weather: the substance remains entirely at the bottom of the tube and the liquid is perfectly clear. Coming rain: substance will rise gradually, liquid will be very clear, with a small star in motion. A coming storm or very high wind: substance partly at top of tube, and of a leaf-like form, liquid very heavy and in a fermenting state. These effects are noticeable twenty-four hours before the change sets in. In winter: generally the substance lies higher in the tube. Snow or white frost: substance very white and small stars in motion. Summer weather: the substance will be quite low; the substance will lie closer to the tube on the opposite side to the quarter from which the storm is coming. The instrument is nothing more than a scientific toy.

Glycerine Barometer.—In an approved glycerine barometer the total length of the tube should be 28 ft. 9 in.; 24 ft. 9 in. could be of composition pipe and 4 ft. of glass. The two may be cemented together, if a proper packing be made, in the form of a ring of metal. One-eighth-inch compo. pipe would do, but it would be better to have it at least ½-in. or ¾-in. diameter. The glycerine is of specific gravity 1·26, coloured with magenta, and should be boiled before use. A glycerine barometer may be made with a tube only 4 ft. long. A bottle is about one quarter filled with coloured glycerine, and the tube (open at both ends) fitted air-tight into it by means of a rubber cork, the lower end of the tube dipping into the liquid. By a powerful blast some air is forced down the tube into the bottle. On removing the

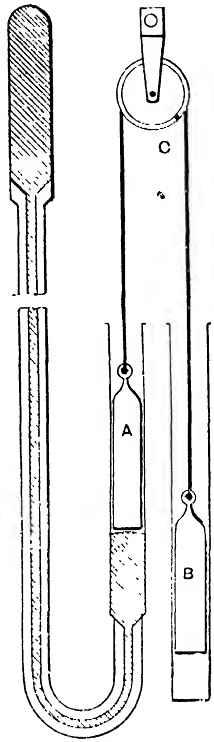


Fig. 55.—Adjusting Mercurial Barometer.

blast, the glycerine rises in the tube until equilibrium is established; the height of this column will vary with the pressure of the atmosphere. A board covered with paper may be attached to the tube, and, by comparing it with another barometer, a scale can soon be drawn on the board that will answer roughly all purposes. A loose plug of cotton-wool placed in the upper end of the tube will keep out the dust.

Mercurial Barometer, Adjusting.—Below is explained briefly how to set the pointer of a mercurial barometer with dial. The

weight A (Fig. 55) is tied to a cord on the under side of the pulley, and the counterpoise B to a cord in the top groove. Pass the cords through small holes at the sides of the grooves, and make a small knot at C to keep the cords in. Then wind each cord once round its groove in the pulley. The barometer is set by turning the hand round on the pulley until the hand stands at the correct reading, which must be taken from a standard barometer.

Mercurial Barometer, Cleaning.—The following answers in the case of an old tube too dirty to be filled: Make a mixture of equal parts of strong nitric acid and sulphuric acids, and pour this into the tube; take care that no drops fall on the clothes or on the carpet. Shake about until the whole of the inside of the tube is wetted, then place the tube on one side for about an hour. Then wash the tube out with water, and dry it by pouring in a little methylated spirit; shake it about until all the tube is moistened, then pour the excess out. Now pour in a little ether, and treat in the same way. Warm the tube very slightly, beginning at the closed end, and gradually work the heat up to the open end, the tube being inclined. The barometer tube will now be clean and dry, and ready for filling with mercury.

Mercurial Barometer: Filling Tube.—It will be advisable first to purify the mercury with dilute nitric acid, as the very slightest impurity in the tube will prevent the barometer recording correctly. To fill a barometer tube successfully requires a great deal of care and patience. When purified, a little mercury is placed in the top of the tube and boiled for some time over the flame of a spirit lamp or a Bunsen burner. The method usually adopted in filling a tube is to make a funnel of clean white paper, and to insert the small end into the opening of the tube. After pouring in a little of the mercury, with the tube held erect, gently depress the tube until the horizontal position is reached. In this position the mercury is boiled. Then allow the mercury in the tube to cool. Again insert the funnel, keeping the tube slanting, not erect,—as at first—and pour in more mercury, letting it run into the tube. Boil again and allow it to cool. This process must be repeated several times, until the tube is quite full. When it is certain that there is no air in the tube (and it is only for this object that the boiling and subsequent cooling of the mercury is maintained), erect the tube again and fill the cistern with more mercury if necessary. Probably, when the mercury has fallen, leaving a vacuum space at the top, a little more will have to be added. The opening is not closed at all, except when it is necessary to remove the instrument from one locality to another. Then a well-fitting cork will prevent any mercury spilling.

Mercurial Barometer: Removing Air from Tube.—It is a somewhat difficult matter to remove all the air from a barometer tube, and it requires a little patience. One of the simplest methods is to place the finger on the open end of the tube and invert, allowing a bubble of air to pass into the long limb; this bubble of air will act as a sweeper, and will carry any small bubbles which may be adhering to the tube with it. Reverse the tube two or three times, closing it with the finger all the while, and finally bring the tube into the proper position, allowing the bubble of air to pass into the short limb instead of the long one; it will thus escape, and the vacuum will then be a good one. Another method is as follows: Cork up the end of the short tube, so that no mercury can escape, invert the tube, and tap the bottom end carefully on a rubber pad; then reverse gently and slowly, so that air does not pass up the long limb. A third method is to invert the tube and move the flame of a Bunsen burner slowly from one end of the tube to the other. The heat of the flame will expand the air, and will drive it to the upper part of the tube. Reverse carefully as before. The heating of the tube is the best method; but some tubes (especially old ones) will not bear this treatment without cracking, therefore it should not be done except in filling new tubes.

Water Barometer.—An apparatus giving rough indications of the weather can be made with a Florence flask A (Fig. 56) and a jar B. Fill the jar with water, and half fill the flask. Invert the flask and insert it into the jar as illustrated. Then tilt

the jar so as to pour out a little of its water, leaving such a quantity that the neck of the flask dips into the water in the jar for an inch or so. The height of the water in the flask will vary with the atmospheric density.

Basins

Cementing Waste Connections to Wash Basins.—For bedding the flange of the brass waste connection to an earthenware wash basin, red-lead is generally used. As, however, red-lead, by reason of its colour,

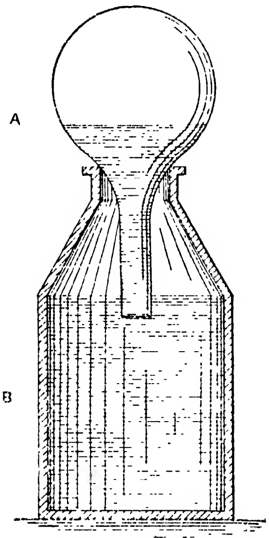


Fig. 56.—Water Barometer.

leaves a dark ring round the brass flange, white-lead is sometimes used round the flange and red-lead outside between the earthenware and the, lead washer behind the fly nut.

Drilling Holes in Lavătory Basin.—Holes can be drilled through the porcelain of which lavatory basins are made, but such a proceeding should be avoided whenever possible. Lavatory basins are very frequently made without any but the waste pipe hole, the supply pipes being carried along the wall, and the hot and cold water cocks being screwed on elbow joints, which are soldered to the supply pipes. The attempt to bore holes through a lavatory basin may, of course, result in the basin being broken. The outer enamel is the hardest part of the basin, and if two indentations can be made in the enamel by blows with a sharp punch, the drill will then begin to cut its way through the substance of the basin. Turpentine should be used for lubricating the drill, and when it is nearly through it must not be driven too hard, because the danger of breaking the basin increases as the drill approaches the point of exit.

Patching Water-closet Basin.—In the case of a water-closet basin that is broken, a small piece being missing, no matter what is done, the patch will always be visible and appear a botch. A strong patch could be made by first obtaining a piece of broken earthenware of the required colour (a piece of an old dinner or breakfast plate would probably do); then chip away the edges of the piece until it fits the hole, and put a Portland cement patch on the outside of the pan. Or a piece of painted calico or fine canvas put on the outside would probaby do instead of the Portland cement. It would be far more satisfactory to buy a new pan. If of an ordinary description, a new pan would cost only a few shillings.

Barrels (*see* Casks)

Baskets

Basket Making.—According to a paper read before the Society of Arts by Mr. Thomas Okey, osiers for basket making are cultivated not on poor, marshy land, but in well-drained upland, loamy soil, well trenched and cleaned. The willows are cut from the cultivated beds of osiers, and when they reach the workman are known to him as rods, which he roughly classifies as osier and fine. The former is generally used brown for coarse hamper work, and is unstripped; the latter, stripped of its skin, and used whitened or buffed, is employed in the manufacture of the finer classes of work —buff rods being rods which have been boiled before stripping, and so stained a rich light brown hue. The technical terms for the sizes into which the rods are sorted are most ancient and curious. The smaller sizes of brown are known as luke, and the

rising sizes as long, small, threepenny middleboro', and the largest as great. The white is more carefully subdivided, and the smaller sizes are known as tack, short small, long small, etc. Ragged is the rough, twiggy stuff which is rejected as valueless for whitening purposes. Having been soaked in tanks the requisite number of hours or days, the stuff is ready for use. The tools required are few and inexpensive:—a shop knife for cutting out; a picking knife for trimming off the rough projecting ends; one or two bodkins for staking up or making handles; an iron for driving the work closely together; a pair of shears for cutting off bottom or cover sticks, and a dog, or commander, for straightening the sticks that form the rigid framework of square baskets. For finer work the rod is split into three or more skeins by a cleaver; the splits are then successively drawn through a shave to remove the central pith and through an upright to render them uniform in width. This is the full kit. An ordinary round or oval basket can be made with no other implement than a knife. Mr. Okey exhibited a paper-basket, which was completed with the aid of no other tool than a pocket knife. The employer provides a lap-board, on which the basket is placed while the sides are being filled up, and a block or vice used for gripping the sticks on which the bottoms and covers of square work are woven. A rod to the workman has four different parts—the butt, the top, the belly, and the back. To make a round basket, the workman first cuts off the bottom sticks from the butt end, slipes them, and places them crosswise beneath his feet, and in this position proceeds to weave the bottom. He first binds them together with two rods called slath rods, and, gradually opening out the radiating sticks, he fills the bottom up to its required width. The first task of an apprentice was confined to making these bottoms—a peculiarly diabolical form of torture known as taking the boy's back-bone out. There is a method of making a round or oval bottom in a sitting position by splitting one layer of the cross sticks with a bodkin and inserting the others. This, however, is rarely practised in Great Britain, and it is scorned by the English workmen as "fit only for women and foreigners." The bottom sticks being cut off (and if the basket is to be a common slewed one), the workman sharpens by two cuts on the back an odd number of stakes which are to form the warp, so to speak, of the sides; these are inserted in the bottom and then pricked up by the point of the knife, gathered into a hoop, and set up or upsetted in the direction of the body of the basket. This being done, it is sided up to the requisite depth, the stakes are bordered down, and the projecting tops are cut off. This is known as the belly. If a foot is needed, it is now put on by inserting the tops cut off from the stakes alongside the upsetted stakes; the foot rods are waled and then laid down as in a border. A cover is made in similar fashion to the bottom, and handles are fixed by twisting a rod and roping it under and over the border. Note that the plural of foot is not "feet," but "foots." The strokes chiefly used are termed: a slew when two or more rods are woven in together; a rand when one single rod is woven at a time; a pair when two are woven alternately, one over the other; a fitch when two are woven alternately, one under the other—this last stroke is used for making skeleton work. A wale is three or more rods woven one after and over the other to form a binding or string course. Besides common borders, many other forms, such as plaited, roped, and tracked borders, are used. Figs. 57 and 58 show a waste-paper basket which illustrates the chief strokes used in basket making. It will be seen that the bye-stakes are merely inserted in the upsett, whereas the stakes are driven in at each side of the bottom sticks and pricked up to form the sides. Bye-stakes are used only in fitched work.

Bleaching Clothes Baskets.—Mix thoroughly 1 part of chloride of lime with 20 parts of water, allow to stand, then remove the clear liquid to a large wooden vat. In this, dip the baskets, and allow them to remain for half an hour, then immerse in dilute hydrochloric acid (1 part acid to 20 parts water), allow them to remain for fifteen minutes, remove, wash in plenty of clean water, and dry slowly.

Staining Basket-work.—Brushing on stains after the basket-work is complete is a tedious process, and one that does not give satisfaction, owing to the difficulty of getting the stain well into the crevices. A better

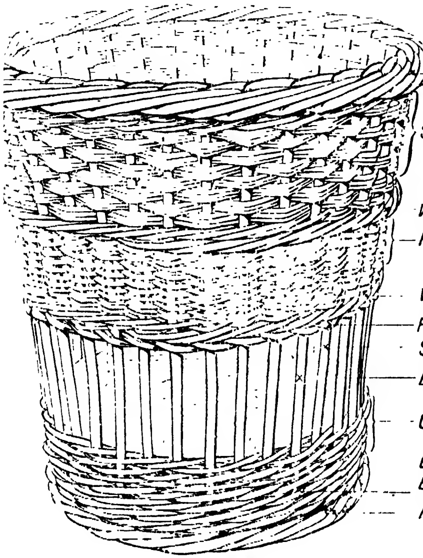


Fig. 57.

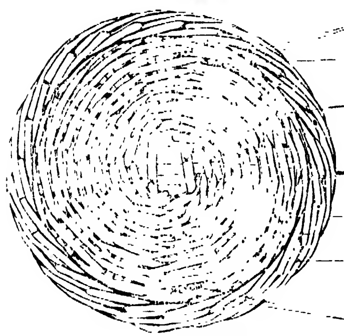


Fig. 58.

Figs. 57 and 58.—General View and Bottom View of Waste-paper Basket, with all Parts Named.

plan is to dye the canes before using. If this is done, the dye must be of such a nature that it will not be affected by moisture, as the canes have to be made damp for weaving purposes. The stains must not be of a kind likely to be injurious to the health of delicate workpeople. The outer skin of the cane presents such a hard surface that few water or spirit stains penetrate sufficiently deep to ensure that the stain will not rub off again with moisture and handling; hence the common practice of colouring up after the articles are made. Where they are required of one colour only, dipping into the stain is far more expeditious than brushwork. For baskets wholly or partly made, this will certainly be the best method. The brown stains used by woodworkers for imitation dark walnut are not expensive. The following, which costs about 4d. a gallon, is recommended:—One pennyworth of nutgalls, one pennyworth of vandyke brown, ¼ lb. of American potash, and 1 gal. of water. Crush the nutgalls, and mix with the potash in about 1 pt. of water; then put in the vandyke, mix well into a paste, and add the rest of the water. It may be used hot or cold. If, after drying, the baskets have a dull appearance, a coat of thin spirit varnish will improve them. Generally speaking, it is advisable to use materials that have been coloured in a proper dyeing establishment. There is a variety of stains applicable to the purpose of colouring basket-work.

Bass

Fixing Bass in Brushes and Brooms.—A soft pitch called brushmaker's pitch is used for sticking the bass. The pitch is kept melted in an iron pot over a flame; the bundles of bass or bristles are just dipped in and then forced into holes bored in the head of the brush, or the pitch is applied like glue to the holes in the broom heads, the bundles of bass or bristles being forced in while the pitch is still hot.

Bassinette (*see* Mailcart)

Bath Brick

Bath Brick.—Named after its discoverer, a Mr. Bath, it is made from slime deposited on the banks of the river Parrett, which winds through the Somersetshire moors. Twice a day the tides bring great quantities of fine sand or silt, and this is deposited on the bed and banks of the river whilst the tide is practically stationary, just before returning. When the water is low, men from the brickyards dig up the soft clay or

mud and wheel it in barrows to the yards, where it is left for some time to harden; then it is ground up fine in a mill, all stones and hard lumps having been removed. The fine and soft clay coming from the mills is made by boys into lumps 1 ft. sq., and these are carted away to the maker, who throws them into a compressing machine, which forces out the clay through a hole 6 in. by 3 in. on to a flat table; a frame above the table has transverse wires about 3 in. apart, and by lowering the frame the strip of clay is cut into about nine tablets. These are left for a time in the open brickfields to dry, and then they are burnt or roasted in a kiln to the well-known light yellow colour. Women trim the burnt blocks to shape by rubbing them on a flat stone.

Baths

Cleaning Enamelled Baths.—Thoroughly wash the enamel with hot water in which soda has been dissolved. If this is not effectual, soak the enamel with spirit of salts, then wash with clean water. If the bath is iron, and the enamel is worn off and the iron exposed, the spirits of salts will aggravate matters, and the only remedy is to have the bath re-enamelled. When the water is hard, this causes the soap to curdle, and the matter should be washed off immediately after the bath is used.

Cleaning Zinc Bath.—The following are instructions on cleaning a zinc bath:—(1) Thoroughly scrub with hot water and soda, and wipe dry. (2) Scour with silver sand and water, using a piece of cork as a rubber, rinse with clean water, and wipe dry. (3) Wash with dilute hydrochloric acid, well rinse, and dry. The latter remedy should be carefully applied, and the solution must not be too strong, or the zinc will be eaten away.

Cutting Hole in Porcelain Bath.—The following explains how to drill a hole for an overflow connection in a porcelain bath. The so-called porcelain bath is really made of fireclay, and has a porcelain enamelled surface. The holes in such baths are not drilled, but are cut and countersunk with a hammer and small sharp chisel in the same manner as a mason would cut a hole through a stone slab. Great care is required in cutting such a hole, which should be large enough to allow for the expansion of the brass overflow connection whenever it becomes heated. Many baths are ruined by neglect of this latter precaution. When ordering new baths it is advisable to let the makers cut all necessary holes.

Re-enamelling Bath.—It is not possible for an amateur to re-enamel or re-japan a bath as the manufacturers do it, as it is a process that requires a suitable oven and considerable practice. Few people have baths renovated in this way, as it necessitates their being taken out and sent to the factory. A good white enamel for home application is made up of 1 pt. of crystal varnish, 1 pt. of gold size, and 1½ lb. of ground zinc white. It is very important that the old surface should be scrupulously clean, well rubbed down, and given a coat of good quality ordinary white paint before the enamel is put on. Another method—available when the bath has been enamel-painted or merely japanned—is first to remove all the old enamel. For this, dissolve equal parts of soda crystals and quicklime in warm water, making a strong solution, and with this repeatedly brush the enamel over until it softens, when it may be easily scraped off. The bath should now be well rinsed with boiling water, to remove all traces of the soda, and then saturated with benzine or turpentine to destroy any rust that may still adhere. Next, rub well down and give two coats of pure red-lead mixed in boiled oil, allowing the first coat to dry thoroughly before applying the second. Now give two or three coats of Aspinall's bath enamel, applied in a similar manner to ordinary paint. A third method is as follows, this being suitable when the bath was previously treated with, say, a vitreous enamel. Remove the old enamel by tapping or scaling off with a small tack hammer. The bath should then be well soaked and rubbed down with turpentine to loosen the scale, then thoroughly cleaned out and freed from grit and given a coat of boiled oil 1 part, turpentine 4 parts. Using an excess of turps thins the oil and helps it to soak into the pores of the iron, thus preventing any further corrosion, at the same time forming a thin film of oil for the paint.

The bath should then be given two coats of paint made as follows: Zinc white paint in paste 3 lb., pale gold-size ¼ pt., and pale copal varnish ¼ pt.; stir well, and thin down with American turpentine. This paint dries hard with a good gloss, and resists the action of hot water. It is also non-poisonous. Bath enamels, as sold in tins, could also be used.

Repairing Holes in Galvanised-iron Bath.—Thoroughly clean the metal at the part to be soldered by scraping with a suitable sharp-edged tool, and then scour it bright with emery cloth. Next apply raw spirits to the cleaned part, and coat it with solder by means of a copper bit, then flow the solder over the hole to render the bath sound. Holes in brass basins are repaired in the same way, killed spirits instead of raw spirits being used for the soldering operation after the metal has been cleaned.

Rusty Bath.—Merely re-enamelling or re-painting will not kill rust. It is absolutely necessary that some means be adopted to kill the rusting process before putting the enamel on; otherwise the rust will soon work through. Remove as much as possible of the rust with emery paper. Then take sulphuric acid, 1 part (use this carefully), and water, 10 parts, and scrub with a brush. Rinse out with lime water, and endeavour to dry with heat (a spirit lamp or two or three short ends of candles under the bath would warm the place). Lastly, rub a little dry quicklime into the affected part, and paint over this. Lime has a wonderful effect as a rust preventative. Plain iron pipes, if once they get furred, never rust afterwards. The fur is carbonate of lime—limestone, in fact. In a short time, the lime would cause most coloured paints and enamels to fade.

Batteries (*see* Electric Batteries)

Bearings

Hot Bearings.—By a hot bearing, says an American technical paper, is meant when a "well-behaved" journal and bearing begin to get sizzling hot, due to the lack of oil, to inferior oil, to the presence of some gritty substance, or to sudden non-alignment. The engineer must keep calm and collected, and not get excited. In the case of an engine's hot crank pin provided with a centrifugal, centre, or telescopic oiler, flood the pin with oil (preferably cylinder oil "mixed" with water) as quickly as possible through the centre oiler or arm telescopic tubes; if there is an assistant, station him at the throttle immediately. Keep on pouring in the oil and water and keep the engine running. If the babbit metal begins to run or fly, it can be assumed that the oil holes are stopped up with babbit; then check the engine down so that it just "turns over," follow the crank pin round with an oil can full of cylinder oil, and get the oil down to the pin by the sides and ends of the brasses. Continue this operation with the engine barely "turning over," until the oil has worked in between the pin and the brasses, or until it begins to cool off; then stop the engine, take out the brasses, clean the pin with a scraper or a smooth file (never use emery cloth or glasspaper), and clean out the oil holes and passage-ways. If only a little babbit has run out of the brasses, scrape them down to a bearing surface, using a paste compound of red-lead and oil, smeared thinly over the bearing surface of the pin. The high places are to be scraped to a bearing surface, using a paste composed of red-lead, putting the brass on it, and moving it round slightly; the red-lead will be rubbed off the pin by the high points of the brasses. A crank-pin brass should only bear or touch the pin in the centre of the brass, the full length of the pin. In the case of a hot crank pin that is not provided with a centrifugal, centre, or telescopic oiler, slow the engine down immediately, so that it is just "turning over"; follow the crank pin round with an oil can and get the oil down to the pin, by the sides and ends of the brasses, until the pin begins to cool off, or until there is no doubt that the oil is between the brasses and pin; then shut the engine down completely and proceed to scrape the brasses as described above. In either of the above cases, if the babbit metal has not started, and the pin begins to cool off after oil has been applied freely, it will be safe to fill up the oil cups and set the engine going at full speed.

Bed Feathers (*see* Feathers)

Bedstead

Fitting Up Bedstead.—It sometimes happens that the laths, or sacking, as it is called in the trade, are cut a little too short, when great difficulty is experienced in getting them on to the studs of the sides and ends. One method of doing this is to put one of the short laths on the middle of the bed by standing on one side and hooking the strip or lath on to the middle stud on the opposite side (there are generally seven or nine studs to a bed), and by pulling at the strip and pressing the knee against the near side of the bed it will be possible to hook it on. Having got the middle one on, the rest will follow suit. Put one on each side alternately, looping another on the next stud on the opposite side; and then by pressing down with one hand the one that is on, the two sides are brought nearer together, and so they can all be got on, one after the other. This principle acts in cases even when the sacking has the holes cut nearly ¼ in. short, and when it has seemed an impossibility to get it on at all. Now as to the course of procedure when the sacking happens to be a bit loose. The oval studs are made with a small piece under the flat oval top, which, when it is turned round, tends to tighten the sacking: but it often happens that the studs, which are nowadays put in by a power press and a star punch, are riveted so close to the angle iron that it is almost impossible to move them with the tiny bedstead key supplied with it. When found in this condition the best plan is to give each side of the stud a smart tap with a hammer; this loosens it sufficiently to enable it to be turned with the key. When fitting up a bed in a private house, it is best to go over all the studs just before putting on the sacking, as this will give a better chance of making a good finish of the job.

Re-painting and Re-lacquering Bedstead.—Assume that the painted parts of a bedstead are to be re-painted, and the brasswork cleaned and re-lacquered. The headrail and footrail of the bedstead must be taken to pieces. Thoroughly clean off the whole of the japan with a shavehook or other tool, then rub down the iron perfectly smooth. For a black paint, mix a quantity of one of the following mixtures: (1) Ivory black and shellac varnish. (2) Melt ½ lb. of asphaltum, and add 1 lb. of hot balsam of copaiba, and when mixed, thin down with hot oil of turpentine. (3) Grind ivory black very smooth with turps on a marble slab with a muller, and add copal varnish till the paint is of the proper consistency; sufficient varnish only must be used to cause the colours to bind and dry firm and work free without becoming either sticky or shiny. The ironwork must then be carefully coated with the varnish applied with a camel-hair brush. About three to five coats must be given, each coat being dried in an oven heated to about 300° F., and if possible the heat must be gradually increased, but not to such a point as will burn the paint. When sufficient body has been laid on, the work will be ready for polishing; this is done in most cases by rubbing down with a piece of felt dipped in tripoli or very finely powdered pumice-stone. Towards the end of the rubbing add a little oil, and when the work appears bright and glossy, rub with oil only. Care must be taken that there is no grit in the polishing medium, or the work will be scratched all over and spoilt. Finish off with a soft cotton or silk duster. The brass part of the bedstead must be boiled for about twenty minutes in a strong solution of soda or potash—say ½ lb. of potash and 1 gal. of water; then well wash in clean cold water and dry. If the old lacquer has been removed, dip the parts in aquafortis by means of brass tongs; when quite bright and clean, plunge in clean cold water, and dry in warm sawdust. The re-lacquering may then be done. It will be better to obtain the lacquer ready made. It must be applied with a large flat camel-hair brush, and the pieces of tubing laid on a hot stove or in an oven to set the lacquer. The various parts of the rails may now be put together, and the bedstead set up again.

A fuller description of the work of renovating bedstead brasswork appears under the heading "Brass: Cleaning and Restoring Bedstead Brasswork."]

Repairing Bedstead.—Assume that the foot of a brass bedstead has been damaged,

the screwed ends being forced out of the tubing. If the foot of the bedstead is flat, not curved, it will be necessary to remove all the rail knobs, and take the end to pieces. Take the iron rods out, straighten them if they are bent, and run a screw-plate over the ends of the iron rods to trim up the threads. New rail knobs and fittings to replace damaged parts must be obtained; they can generally be had at a large furnishing ironmonger's. The end must be built up again exactly as it was at first and fixed in end pillars; then, when completed, fix on the side frame.

Replacing Casters on Bedsteads.—The replacing of casters on iron or brass bedsteads is a comparatively simple matter. The method usually employed with the first set of casters is to place the caster on the pin, follow with a small washer, and then rivet the pin. To replace a caster in the same way, it will be necessary to raise the end of the bedstead and rest the lower rail on the seat of a chair, leaving the legs of the bed free to work on. The washer can be wrenched off with a pair of pincers, to remove the old caster, which will slide over the rivet, but the burr will have to be filed off the pin before another washer can be put on and riveted. Care must be taken not to strike the metal of the casters, as they are of cast or chilled iron, and are very brittle. A simpler method, after placing on the caster—which will go on without filing the pin—is to put on an open metal ring and close this with the pincers, instead of using a washer. This is all that is required, as there is no particular strain on the washer; but the caster should go well up on the pin, or it will not turn freely when on the floor. A touch of oil will make it turn easily, and prevent rusting. Bed casters, and the small rings for adjusting them, can be had at any wholesale ironmonger's in various sizes. Although such a simple thing, the open ring washer is the subject of a patent. Its full name is the Colgryp detachable caster washer. Readers who happen to have a bedstead fitted with Colgryp washers will not have very much difficulty in replacing casters, should any happen to get broken. It will be noticed, on examination, that the caster peg has got a small groove turned in it, into which the washer fits. By inserting a screwdriver at the opening of the ring, it can easily be pressed upwards away from the caster and prised open, taken off, and the broken caster replaced by a new one; and being made of soft iron, it can be used again by pressing it into the groove.

Beeswax

Adulteration of Beeswax.—To detect the adulteration of beeswax, it often suffices merely to determine its specific gravity, melting point, etc., but perhaps more certain results accrue from the following methods. Fehling's method is to boil the wax in 92 per cent. of alcohol for about one minute, allow it to cool, and then filter; an aqueous solution of calcium chloride is added, and the wax becomes cloudy; probably stearic acid is present in it. A pure wax should remain clear when cool after 10 parts of it (by weight) have been heated with 120 parts of water and 1 part of sodium carbonate. Donath's method is to boil 1 part (by weight) of the wax for one minute in 8 parts of nitric acid, to thin with an equal volume of water, and to treat with an excess of ammonia. The poured-off liquid will be yellow or straw-coloured in the case of pure wax, but if the wax contained resin as an adulterant, the liquid will be red, yellowish-red, or brown. The natural wax is usually dull yellow or greenish-yellow, and has a decided characteristic odour either when cold or on heating; split with a knife it breaks in conchoidal masses with a rough fracture. Artificial beeswax is usually of a brilliant orange colour, has no odour when cold, but smells of paraffin-wax when heated; split with a knife the fracture is smoother than with the pure wax.

Bleaching Beeswax.—Pure white wax may be obtained by exposing ordinary beeswax to the weather and sun. Sacking or coarse cloth is stretched on frames above the ground, and the beeswax cut into thin flakes and laid thereon. Occasionally soft water is sprinkled on the wax to moisten it, and it is turned over frequently. Four weeks is about the average time required. Should the wax appear yellow inside when broken, it should be melted and cut up and

exposed again. It is claimed that much time is saved if melted wax and steam be passed through long pipes into a pan heated by steam. Here it should be stirred with water and allowed to settle. This operation may be repeated once or twice.

Rendering Beeswax.—For a small quantity, tie it up in a piece of cheese-cloth, together with a large stone or some heavy weight, and boil it in a deep saucepan, using plenty of water to which sulphuric acid has been added in the proportion of a teaspoonful to the gallon. Let it boil gently for an hour or two, then allow it to cool, and when cold the wax can be removed in a solid cake. If very dirty, boil up again in a piece of fine muslin. Any dirt which then clings to the bottom of the wax cake can be scraped away with a knife. When large quantities of comb have to be dealt with, a proper extractor is necessary.

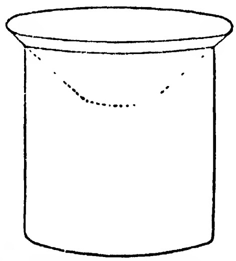


Fig. 59.—Beetle or Cockroach Trap.

Beetles (Cockroaches)

Poisoning Beetles.—For a persistent pest of beetles there are many poisons and traps on the market; but there is none so efficacious as phosphor-paste mixed with ordinary brown sugar, equal quantities of each. The paste is obtainable at any oilman's shop in 1d. bottles. These are better than 3d. or 6d. pots, as the paste is a material that does not keep well when once the pot is opened. Mix the paste and sugar, and put small quantities on pieces of paper in the likely places. The paste is poisonous, and should there be any risk of animals or children touching the mixture, push some of it (using the blade of a knife) into all likely cracks and crevices. If this is done on one evening, then again about three days later, and then once a fortnight for a few times, the worst case can be cured. The beetles simply disappear, and possibly not a single dead one will be seen; there is no odour, nor any disagreeable feature in this method. The phosphorus is said to cause the beetles to shrivel up; but this is uncertain. Bracken strewed about is said to be a cure; the beetles eat it ravenously, and die. Cucumber rind is credited with similar properties Sandford's rat poison, if laid down in very small pieces, and fairly plentifully, alongside the walls and about the runs of the beetles on two or three evenings (at intervals of a day or two), will effectually eradicate them for the season; they eat it most ravenously. Neither dogs nor cats will eat it, but where chickens are kept, care must be taken to sweep up and burn any remnants. It has been stated, as the result of experience, that if powdered borax is sprinkled in the cracks and on the floors about the places where the beetles are most likely to come from, they will entirely disappear after a time.

Trapping Beetles.—It is exceedingly difficult to make a clearance of cockroaches, once they have obtained a footing in a house, for the reason that their haunts cannot easily be reached. A beetle trap known as the "Demon" is satisfactory in use, but a home-made appliance which will prove effectual is a vessel- one which is glazed inside and has steep sides is essential —placed on the floor of the frequented apartment. In the bottom is placed a little stale beer or yeast. A glass gas shade of conical shape, such as is used chiefly with argand and mantle burners, may, if preferred, be placed small end downwards, resting on the rim inside the vessel (see Fig. 59). Gangways, formed of pieces of wood reaching from the floor to the top of the pan, are arranged plentifully round the sides; up these the insects, attracted by the smell of the beer, quickly pass, fall over, and are drowned. The trapped beetles should be burnt, as some may otherwise recover. As cockroaches multiply very quickly, the trapping must be persisted in as long as any specimens are discoverable. A simple cockroach trap is a round and shallow metal box having a convex cover

and holes in the sides; in the holes are placed short tubes slightly inclined upwards inside the box, the holes outside being almost on a level with the ground, so that they may easily be entered by the insect. A little stale beer is poured into the box, and whilst the cockroaches can easily get to the bait, it is impossible for them to get away owing to the inside ends of the tubes being out of their reach. When the trap is full, hot water is poured in to kill the insects.

Bell

Cleaning Old Bell.—Usually bells are made from a special alloy termed bell metal, rich in copper and tin. The best method to clean the dirt from a bell will be to go over it well with a soft flannel and some paraffin. This will thoroughly remove the dirt without appreciably affecting the metal or destroying the antique appearance. After cleaning off in this manner, if the finish is satisfactory, give it a coat of transparent enamel, such as a celluloid varnish—a good one, easily applied, being Zapon, sold in shilling bottles.

Electric Bell (*see* Electric).

Bellows

Mending Forge Bellows.—The following instructions apply to the repairing of a hole in a pair of forge bellows. Thoroughly clean the leather for some few inches around the hole. When perfectly dry, cut a piece of good soft, stout, tanned sheepskin, about 3 in. larger all round than the hole. Pare the edge of this piece, then with an old tooth brush smear it lightly all over on the flesh side, and also that part of the leather on the bellows where the new piece is to be fixed, with rubber solution, as used for joining together waterproof material. Let the job stand for a time to allow the solution to get "tacky," fix the patch over the hole, well rub the leather, and leave it to dry. Next break the leather into the folds of the bellows. If the above instructions are properly carried out, a good repair should result. The above information is given by a practical leatherworker, but another expert holds a different opinion as to the effectiveness of cement. He says that the only satisfactory way of patching a bellows is by sewing on the patch. To do this will be required a circular piece of leather large enough to cover the hole and leave sufficient room for sewing, a waxed thread with a bristle attached at each end, and a cobbler's stitching awl.

Belts

Body Belts, Whitening.—To whiten soldiers' belts and straps, make a thick paste of pipeclay and water; also dissolve a little white starch in water; mix the two together. A very small quantity of blue may be added. Apply with a clean sponge, and hang the articles up to dry. Sometimes glue is used in place of the starch. A preparation of pipeclay called "Blanco" is largely used in the army for the purpose. Another method is first to clean off all the old grease, pipeclay, etc., using a stiff brush and clean water, then allow the leather to dry thoroughly; now rub it quite smooth with a bone or knife-handle, and give a coat of paste, made as follows: Take one square of pipeclay and put it whole into a small saucepan; add enough water to cover it. Put it on a slow fire, and skim off the scum as it rises till no more appears. Let it stand till cold, pour off surplus water, and beat the clay into a stiff paste; add two teaspoonsful of boiled starch and a trace of blue. Apply with a soft brush. Be careful not to apply too thick. When quite dry, polish with a clean soft rag, and the white will not rub off.

Machine Belt, Cleaning.—To clean machine belts, sponge them well on both sides with naphtha and then rub in some neatsfoot oil, afterwards hanging the belt in the heat of the sun for a day to dry.

Machine Belt Dressings.—Some users of machine belts make an adhesive by mixing about 3 parts of resin with 1 part of tallow. This composition is applied hot, or in a liquid state. A solution of indiarubber, oil, resin, and tallow is also used as an adhesive. If the belt has become hard and dry, proceed as follows:—Well cleanse the belt with hot water and soap, and rinse with clean warm water. While the belt is moist, rub well into it some dubbin, and let the belt dry at a tension. The dubbin may be made by

melting over a fire some good tallow, and adding one-quarter its weight of cod-liver oil; allow to cool, when the dubbin will be ready for use. Whenever there is a tendency for the belt to slip, brush off any dust that

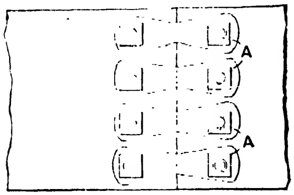


Fig. 60.—Canvas Belt connected with Jackson's Fasteners.

may be on the belt, and place a little castor oil on the side next the pulleys. Should the oil fail to have the desired effect, take the belt up to driving tension. If the belt is worked on pulleys that are too small, it will slip, unless it is very much over-strained. For a good dressing for leather belts, heat to about 120° F. 2½ lb. of uncured india-rubber, and mix with it 2½ lb. of rectified oil of turpentine. When well mixed, add 1½ lb. of clear resin and 1½ lb. of yellow wax. Dissolve 3 lb. of good tallow in 7 lb. of fish oil by heating, and mix in it the above solution. Rub the mixture well in on both sides of the belt. When the belt shows a tendency to slip, apply some of the solution to the inside, or side of the belt next the pulleys, first brushing off all dust.

Machine Belt, Joining.—The following is a recipe for a cement or glue for splicing leather millbands. (1) Dissolve guttapercha in bisulphide of carbon until it is of the thickness of treacle. The parts to be joined must first be well shaved down and then a small quantity of the cement poured on; spread it evenly over, then warm the parts for about half a minute, place them together quickly, and press hard. The cement should be kept in a corked bottle in a cool place. Other cements are:—(2) Stir half a pint of good hot glue with a tablespoonful of glycerine and half a teaspoonful of turpentine. (3) Melt together in an old iron saucepan half a pound of guttapercha, 1 oz. of pitch, 1 oz. of shellac, and 1 oz. of sweet oil. Use hot. (4) Dissolve gelatine in acetic acid. (5) Add as much tannin to glue as will make it ropy. (6) Melt together guttapercha, 20; pitch, 2; shellac, 1; and linseed oil, 2 parts. (7) Digest guttapercha 3, and caoutchouc 1, in 4 parts of carbon bisulphide. Belt joints should not depend entirely on the cement, but should be stitched as well. Take the case of a canvas belt which is to be both cemented and stitched. To piece such belting properly, it would be necessary to cut the stitches in order that the layers of canvas may be placed in proper order, one over the other. A cement may be made according to the No. 6 recipe above. Paint the parts to be joined while the cement is hot, join as above, and weight down until the cement is properly set; then remove the weight and stitch the splice or joint with strong twine. As the above would be a very tedious method of joining machine belts, Jackson's patent fasteners may be recommended for the purpose. These are obtainable from most machine-belt makers. The method of joining the canvas is very simple, and is quickly accomplished. The ends of the belt are simply butted together, as indicated in Fig. 60. The fasteners A are secured by means of small bolts (*see* Fig. 61) passed through holes in the plates, and corresponding holes are punched in the belt. Nuts are then screwed down firmly on the plates, as shown. Suitable spanners

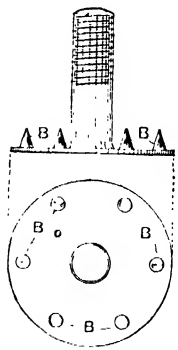


Fig. 61.—Jackson's Fastener for Machine Belts.

are supplied with the fasteners, for turning the nuts. The points B of the fasteners (*see* Fig. 61) catch into the under side of the belt as the nuts are being tightened. This method of joining machine belts is

preferred to the apron and laced or riveted joint.

Benzene, Benzine, Benzoline, etc.

Benzene.—Benzene is a hydrocarbon C_6H_6 formed during the dry distillation of organic substances. It is contained in coal tar, which, on being distilled, yields a light oil, which is washed with sulphuric acid and with a solution of soda and again carefully distilled; the portion passing over between 80° and 90° C. is separately collected and forms benzene. Benzene is a light volatile liquid, very refractive, and has a peculiar gas-like odour. It readily mixes with oils, etc., but not with water, and is a powerful solvent acting on fats and indiarubber. It is used largely in the manufacture of aniline dyes, for cloth cleaning, and in rubber working. Benzene is very inflammable, burning with a bright but smoky flame.

Benzine.—This is generally petroleum spirit—a distillation from crude petroleum—but unfortunately the two terms, benzene and benzine, are very frequently confounded. The name benzine is sometimes applied to petroleum spirit and sometimes to coal-tar naphtha, but the name benzene is always applied to coal-tar naphtha. As there is often a doubt about what the names refer to, the synonymous terms are placed together:—

Benzene.	Petroleum ether.
Coal-tar naphtha.	Petroleum naphtha.
Benzol.	Benzoline.
	Benzine.
	Light petroleum.
	Petroleum spirit.
	Rock naphtha.

Cleaning Benzoline.—A simple method of cleaning benzoline is to get a golden syrup tin and solder a piece of stout wire on the lid to form a handle. Also solder a piece of brass tube, $\frac{3}{8}$ in. diameter and $\frac{5}{8}$ in. long, in the side at $\frac{3}{4}$ in. (measuring from the centre of the hole) from the bottom of the tin. Fit a good cork to this tube, the inner sharp edge of the tube being nicely rounded off to allow the cork to enter easily. The dirty benzoline is poured into the tin and allowed to stand for about twenty-four hours. Then the cork is withdrawn, and the benzoline flows into another vessel. With care it is possible to get away nearly all and leave the dirt at the bottom of the tin.

Incombustible Benzines and Ethers.—For rendering ethers and benzines incombustible, a method is to add carbon tetrachloride in suitable proportions. This is a slightly volatile body, which can be dissolved cold in ethers, alcohols, and other products. For benzine, absolute incombustibility is said to be secured with 25 or 30 per cent. of the tetrachloride. The result of numerous experiments shows that ignited benzine is extinguished if carbon tetrachloride is poured on the flames; it acts by solution in the benzine, and there is, therefore, the possibility of using the tetrachloride as an extinguisher of fire. For this purpose it may be either enclosed in grenades of thin glass to be thrown on the fire, or, as in the Decrut method, directly projected by means of a pump.

Bichromate (*see* Potassium Bichromate)

Bichromate Battery (*see* Electric Battery)

Bicycle (*see* Cycles)

Benzoic Acid

Detecting Benzoic Acid in Preserved Fruit.—Benzoic acid is used for preserving fruit products. Extract a suspected sample with chloroform as described much later in this book for salicylic acid; remove the chloroform layer and place it in a white saucer, or, better, in a plain glass sauce dish. Set a basin of water—as warm as the hand can bear—on an outside window ledge and place the dish containing the chloroform extract in it, closing the window until the chloroform has completely evaporated. In this manner the operation may be conducted with safety even by one who is not accustomed to handling chloroform. In warm weather the vessel of water may, of course, be omitted. Benzoic acid, if present in considerable amount, will now appear in the dish in characteristic flat crystals. On warming the dish the unmistakable irritating odour of benzoic acid may be obtained. This method will detect benzoic acid in

tomato catsup or other articles in which it is used in large quantities. It is not sufficiently delicate, however, for the smaller amount used with some articles, such as wine. It is often convenient to extract a larger quantity of the sample and divide the chloroform layer into two portions, testing one for salicylic acid, and the other for benzoic acid (*see also* Salicylic Acid).

Billiard Balls, Cues, etc.

Billiard Balls, Bleaching.—White balls can be restored to their original colour by steeping them in a solution of hydrogen peroxide to which a few drops of ammonia have been added. The bleaching can be hastened by subsequently exposing the balls to sunlight; if they are then not sufficiently bleached, the treatment should be repeated.

Billiard Balls, Dyeing.—The colour of red balls can be restored by dyeing. For this purpose, take 1 oz. of cochineal, add 7 oz. of water and a few drops of strong ammonia, and boil; strain and make up to 7 oz. again with water. Place the billiard balls in this solution and warm it until the balls are sufficiently coloured, then remove, rinse in water, and allow to dry slowly. Another method of dyeing billiard balls red is to soak them in water to which a very small quantity of vinegar and sufficient aniline red have been added. To obtain a deep red colour, use coralline; for amaranth, use eosine; and for crimson, use fuchsine. When the ball is the desired colour, rinse in clean water, and after drying, polish with soap and Vienna lime.

Billiard Chalks.—Some white billiard chalk is prepared from a naturally occurring soft magnesian limestone, simply by cutting it into square blocks, in which small hollows are then turned. The blue chalk may be prepared by mixing the pulverised limestone mentioned above with sufficient ultramarine to colour, moistening the mass very slightly with water, and pressing into shape with a powerful press.

Billiard Cue, Polishing.—Billiard cues may be french polished; or they may be given several applications of brown hard spirit varnish, applied with a camel-hair brush. Allow at least one hour to elapse between the first and second coatings, and a longer interval between any others that may be laid on. Should the varnish cause the wood to come up rough, smooth down with No. 0 glasspaper and linseed oil. Wipe quite free from oil before applying more varnish. A fine finish could be secured by grinding the second and third coatings. when thoroughly hard, with fine grade pumice powder, emery powder, or Bath brick and water, and then giving a final coat of varnish; finally, set the cue aside in a fairly hot room to dry, but not near a fire or stove.

Billiard Cue Tips, Fixing.—For fixing tips on billiard cues, liquid cement sold in bottles is generally used. They may also be fixed with specially prepared wafers, or with a special brass fastening. A suitable cement may be made by covering gelatine with strong acetic acid and after a few hours melting down by a gentle heat. The cement must be applied while still warm, and the cues should be allowed to stand aside for a day or two till it hardens.

Billiard Table Cloth, Removing Stains from.—If the grease has gone through the cloth to the rubber underneath, a kind of rotting process will follow that will destroy the rubber. Wash the cloth with ammonia solution. A piece of lump ammonia, costing a penny, dissolved in ½ pt. of hot water, and applied with a sponge or rag, will also wash out grease: but it will, probably, also remove colour. Benzine will also remove grease, but should not be used in the presence of any kind of fire. To remove glue stains, dip a sponge in hot water and apply it to the stains. To remove a paraffin stain from the baize of a billiard table, procure some pure benzene, also several sheets of clean blotting paper. Place the blotting paper on the stain and over it run a moderately hot smoothing iron; continue this as long as the paper takes out any oil. When it ceases to do so, wet the stain with the benzene and again treat with the paper and hot iron. Continue this treatment until no more oil can be removed. Finish by brushing with a clothes-brush to remove the dust.

Binoculars (*see* Optical Glasses)

Bird Stuffing, etc. (*see* Taxidermy)

Birdlime

The following are recipes for birdlime :—(1) Birdlime may be made from mistletoe berries. Procure about ½ pt. of berries, place them in about 1 pt. of cold water, and let them simmer till they begin to burst. Turn the whole into a sieve and allow the water to drain away. Mash the berries with a spoon or in a mortar, and then cover them with cold water.. By working up the crushed mass with the fingers under the water the useless parts will be separated. Now allow the whole to settle, pour away the water, and the birdlime is ready for use. (2) It may also be made from the inner bark of holly by boiling for several hours and then allowing it to ferment. (3) The more common method is to make birdlime from linseed oil. Procure any thick, hard-burnt earthenware vessel capable of holding over 1 pt.; into this put about ½ pt. of *raw* linseed oil. Now place it over a red coal fire (not a blaze) and let it boil gently for three or four hours. Towards the end of the third hour it may be tested by dipping in a bit of wood and plunging it into cold water; then, by feeling it, some idea of the strength may be obtained. Good birdlime should allow a thread to be drawn nearly 3 ft. without breaking. Towards the end of the boiling the mass may suddenly become too thick and consequently useless. It is therefore best to take it off the fire before it is quite done, as the intense heat of the substance will then finish the work. Always keep it covered with cold water when not in use, or it will become hard and useless.

Blackboards

Canvas Blackboards.—Below is explained how to make portable canvas blackboards. The canvas should be stout and as free as possible from knots. Where these occur, flatten them by holding a flat-iron underneath and striking the upper surface a few light blows with a hammer. Then evenly stretch the canvas on a large board or framework by nailing tacks round the edges about 2 in. apart. Give the surface of the canvas two strong coats of size, and then two coats of white-lead oil colour to which lampblack has been added; and to ensure quick and hard drying, use patent driers and a fair quantity of turps. These coats should be allowed to dry for a few days so as to become hard. Then rub down the surface with pumice stone and fine glasspaper. Then a third coat should be applied. After this has become well set, rub it down with fine glasspaper. Should a fine surface be required, a fourth coat may be necessary. Finally, the surface may be treated as follows: Take ultramarine blue 4 oz., shellac 1 lb., ivory black 8 oz., finest flour emery 5 oz., alcohol 1 gal. Well mix the alcohol and shellac together before the other ingredients are added, and then mix the whole; it must be kept tightly corked, and before being used must be well shaken. As the solution soon sets hard, just enough for immediate use should be poured out into a pot. The solution should be applied with a flat varnish brush. Shellac and ivory black only may be used for the first coat, and when dry rubbed down with very fine glasspaper or pumice stone. The blackboards may be used on rollers, or the canvas may at once be transferred to a permanent stretcher; or, if required, the canvas may in the first instance be fastened to its intended support.

Cracks in Blackboard.—If the crack is ⅛ in. or more wide, a slip of wood should be fitted and glued in the opening and afterwards planed down level to the surface of the board. But if the crack is less than ⅛ in. wide, it can be filled in with a mixture of plaster-of-Paris, glue, and a little lampblack. This should be allowed to dry, and then scraped and glasspapered flush with the surface of the board.

Dressings for Blackboards.—The following is a suitable mixture for coating blackboards: —Shellac 1 lb., bone black ½ lb., finest flour emery 5 oz., washing blue (powder blue) 4 oz., and methylated spirit 1 gal. Place the shellac and spirit together, and shake from time to time till the shellac is dissolved, then add the other ingredients. Each time the mixture is used shake the bottle thoroughly, and pour some of the liquid into a shallow can; dip the brush into this and stir round at each application; the emery is so heavy that it settles out rapidly, and does not get on to the board unless it is well

stirred. This recipe in question is most reliable if the materials used are of the best class. Unfortunately, much of the bone-black in the market is of a weak character; should, as a result of this, the recipe prove unsatisfactory, use ¾ lb. of best carbon black

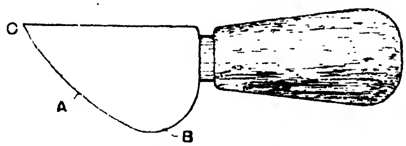


Fig. 62.—Blind-cutter's Knife.

with 1 oz. of Prussian blue, and, with 1½ gills of raw linseed oil, add these to the other ingredients (that is, the emery, shellac, and spirit). No previous preparation is needful so long as the wood is dry and clean and the composition is intimately mixed and in a very fine state. Be sure that the emery is of the finest. An expert recommends that after the coating is hard one or two coats of a medium spirit varnish should be applied. This is made of 5 oz. of white shellac dissolved in 1 pt. of methylated spirit and coloured with ¼ oz. of aniline black soluble in spirit. On this finished surface the chalk should rub clean out and leave no marks whatever. However, generally speaking, a varnish finish would not be satisfactory.

Wall Blackboard.—For obtaining a blackboard surface on walls, etc., a patent method is to apply a composition of 1 part plaster-of-Paris, 2 parts lampblack, and 3 parts Portland cement. The ingredients are thoroughly mixed and blended into a homogeneous compound, a sufficient quantity of water being added to give the consistency of paste. The compound is then spread where required with a trowel or other tool, or it may be moulded into slabs and secured to the walls in any desired manner. The crystallisation or setting holds the lampblack unchanged in the mixture, forming a solid impervious cake of the same density and colour throughout its mass. The compound thus applied presents a hard, black finish which will effectually resist the action of water, will not rub off, and will readily take chalk-marks, which may be easily erased.

Blacklead

Blacklead.—This is a form of carbon midway between charcoal and the diamond, as explained under the heading "Graphite," a term with which "Blacklead" is practically synonymous.

Blacklead Polish.—To make a polish of blacklead, soap may be added, and also a small quantity of clay, kneaded with water. There are two methods by which squares of such a material could be produced: firstly, by rolling it out into a sheet and dividing it with a cutter; and, secondly, by pressing it in a mould. The second plan is the one most generally followed, and it yields the best results. When soap is added, it is heated in about four times its weight of water, and when nearly cold, turpentine and sufficient blacklead to make a stiff paste are stirred in. Try the following proportions: Soap 1 lb., water 4 lb., turps ½ lb., blacklead (pure, pulverised) 1 lb. to 1½ lb. If this turns out too stiff, add more water; or if too soft, use more blacklead. (*See also* "Stove Polish.")

Ordinary Paste Blacklead.—For paste blacklead, the best Ceylon blacklead or graphite should be used; this is crushed to powder and ground with a little gas black or ivory black, which will improve the colour, and sufficient glycerine, mixed with an equal quantity of water, is added to form a paste.

Blei-wolle (*see* Lead Wool)

Blind Making and Fixing

Simple Roller Blinds.—For cutting the holland of which a roller blind is made,

Fig. 63.—Scriber for Marking Blind Stuff.

a wood straightedge is required about the length of the bench or table used and 2 in. wide; also have one 5 ft. long, for short work. The material is cut with a knife shown by Fig. 62. The heel B of the knife, or a common metal skewer (Fig. 63), may

be used as a scriber. It is quite unnecessary to hem the edges, except cut edges, which would otherwise fray; the holland can be obtained in a great many different widths. In measuring for a blind, the length of the window ("drop" of the blind) is taken

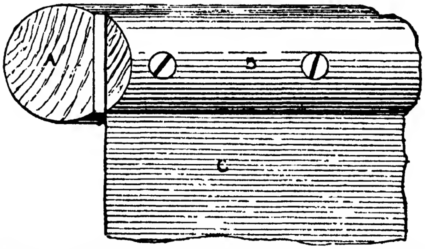


Fig. 64.—Fixing Blind to Roller with Screwed-on Strip.

from the top bead of the casing to the ledge, and the width between the side beads. Cut the material 6 in. longer, and 2 in. wider. Suppose, for example, the given measurements are 6 ft. by 3 ft. A roll of 38-in. material is laid across the bench at the left-hand end, and the straightedge put on the free end of the stuff, which is rolled to the other end. Have a straight line marked across the bench about 2 in. from the end, and quite square with the long edge nearest the worker, with which edge the material is kept even; then the wood straightedge must be put to the mark and the cutting edge A (Fig. 62) of the knife drawn across. This squares the end. Then mark off 6 ft. 6 in., and cut off likewise. The straightedge is then laid on exactly even with the end of the stuff, and the heel B of the knife, which is blunt, is drawn across to make a crease where it is to be folded for the lath hem, about $\frac{1}{2}$ in. of the cut edge being turned in. It is then sewn, and the lath put in. The roller must be $1\frac{1}{2}$ in. longer than the width of the blind, to allow $\frac{3}{4}$ in. free play at each end for the material, which should be fixed on with the steel fasteners supplied for the purpose. When the blind is put up complete, and drawn to its full extent, it should still retain at least one turn round the roller, so as to hide the bare wood, and give the blind a start to run up. The tassel and cord should be exactly central on the lath, or the blind will not wind straight. Assuming that special fasteners are not used for attaching the holland to the roller, remember that it makes a stronger job to tack on a length of narrow tape or a strip of the holland before attaching the blind, which is thus prevented from tearing away if it happens to run down. It is a good plan to make a pocket for the roller, for the blind is often subject to sudden pulls which may drag it away from the roller if this is simply tacked to the edge of the blind. Also it is much easier to detach the blind from the roller if at any time this is necessary. Fig. 64 shows a great improvement on the use of tacks for attaching blinds to rollers. The roller is sawn lengthwise in two pieces, one about twice as thick as the other (see Fig. 64). Shorten the small piece to the exact width of the blind. Double the end of blind and insert it between the two pieces. Keep in position, taking care that the blind hangs true, and secure it with three or four small screws. One part of the sawn roller should be large enough to hold the ends, which are usually fixed with three screws. The other part should stand clear of the ends, so that there will be less trouble in detaching or replacing the blind. A blind roller must, of course, be of the same circumference at each end, and it should be straight. A cylindrical roller, being machine-made, is not so likely to differ at the ends as the hand-planed octagon (see Fig. 65); although it is perhaps even more likely to be crooked. The simplest way to make an octagon roller is to get the squares machine-sawn,

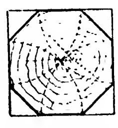


Fig. 65.—Octagon-section Blind Roller cut from Square-section Wood.

and then to plane them accurately to square section. The blind-maker generally has a V trough, in which the square piece of wood is placed, with the diagonals in vertical and horizontal planes, and he removes the angles with a jack-plane, the amount to be

removed being judged by his eye; and if a tape wound round each end of the completed roller shows equal results, he is satisfied. A blind roller should have its axis, on which it revolves, fixed horizontally. In an old building the soffits may not be level. When the blind is fixed between the beads, or in the space reserved for the upward movement of the lower sash, blocks are used. These blocks not only serve to support the blind, but also stop the upward movement of the lower sash-frame, thereby protecting the blind from injury. If necessary, these blocks can be

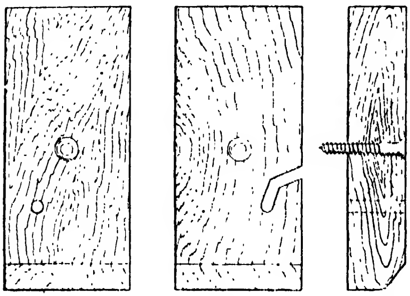


Fig. 66. Fig. 67. Fig. 68.

Figs. 66 to 68.—Inside Blocks for Blind Rollers.

made of different sizes, to ensure the roller being supported horizontally. Figs. 66 to 68 show face and side views of these blocks, which are generally made 3 in. long, $1\frac{3}{8}$ in. wide, and not less than $\frac{5}{8}$ in. thick. Outside brackets (Figs. 69 to 74), being quite independent of each other, may always with care be fixed at the same level. The arrangement of a blind upon a roller fitted to brackets attached to a lath that can be fixed to either a vertical or horizontal surface has much to recommend it, because all adjustments can have been previously made, and the lath alone requires to be fixed. Instead of the wood-blocks, brass nipple brackets (Figs. 75 and 76) are sometimes used; and the plate bracket (Fig. 77) also. These are always used when the roller is fitted on a lath. When this form of bracket is used, the blind roller is put in or taken out by springing the plates, which are sufficiently elastic to return to their place after the pressure has been removed. The pins in the ends of the roller must in this case be short, and the fit of the roller close, to avoid the necessity of bending the plates to any considerable

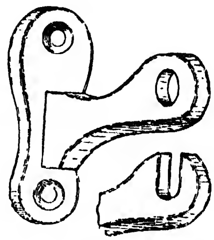


Fig. 69.

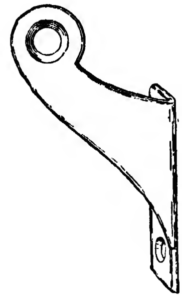


Fig. 70.

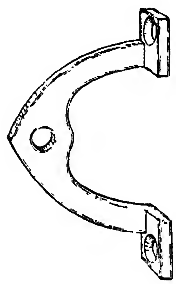


Fig. 71.

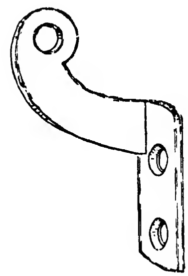


Fig. 72.

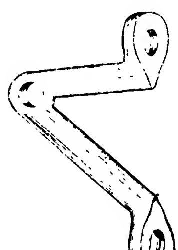


Fig. 73.

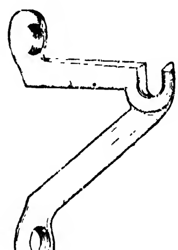


Fig. 74.

Figs. 69 to 74.—Roller Blind Brackets.

extent, which would soon permanently alter the distance between them. A roller blind is usually drawn up by an endless cord, passing over a V-grooved wheel (Fig. 78) fixed to the roller, and a small pulley (known under the general term of "rack pulley," shown in Figs. 79 to 83), at the

lower end of the loop, made adjustable by various contrivances to secure the proper tension on the cord, a screw and nut often taking the place of the rack. Of late years

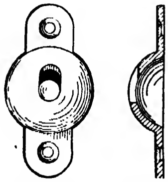


Fig. 75. Fig. 76.

Figs. 75 and 76.—Brass Nipple Brackets for Roller Blinds.

rollers fitted with a flanged heel (Fig. 84) at one end, and having a cord wound the reverse way to the blind, have been much used. With these the blind is raised by pulling the cord, and so unwinding it from the reel; they are called single-line rollers, and are very good if the cord is strong; but should it break, the blind unrolls rapidly, and may tear away from the roller. These single-line reels are used

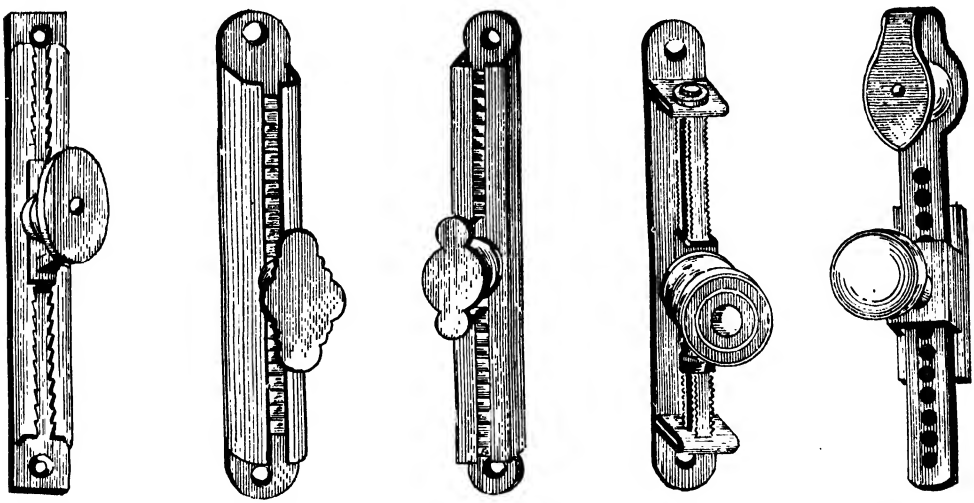


Fig. 79. Fig. 80. Fig. 81. Fig. 82. Fig. 83.

Figs. 79 to 83.—Rack Pulleys for Roller Blinds.

with metal brackets (Figs. 69 to 74), suitable for fixing to a vertical surface, but the plate bracket (Fig. 77) is often used for single-line rollers. The cord used is a small woven flax cord, weighing about 1 lb. to the gross, generally made fast to a Young's patent cord-holder (Fig. 85), one turn of a cord round this hook sufficing to hold it.

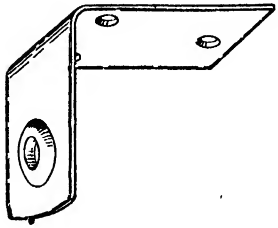


Fig. 77.—Plate- or L-form of Blind Bracket.

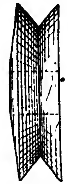


Fig. 78.—V-grooved Boxwood Wheel for Blind Roller.

When the blind is down, and therefore heaviest, the cord sometimes embeds itself in the coils on the reel in drawing; the flanged reel diminishes the length of roller available for the blind, which is thereby rendered too narrow when the blind has to be fixed between beads. Wherever it is possible to fix the blind on the face of the sash-frame, the single-line roller may be employed by making the roller as long as the opening between the linings will permit,

which will generally give room for the reel and still permit the blind to cover the whole of the glass.

Spring Blind Rollers.—Spring blind rollers are made of a steel case, or barrel, of diameter according to the size of blind, from about $2\frac{1}{2}$ in. diameter for lengths of about 7 ft. to 4 in. diameter for long rollers, say 16 ft. long. The barrels are a speciality. Inside the barrel is fitted a round iron rod, or two rods, one at each end, of $\frac{1}{2}$ in. to $\frac{3}{4}$ in. in diameter; the external ends project from the end of the barrel about 1 in., and the cylinder is reduced by filing to a square section. This squared end rests in a square hole cut in a piece of stout iron fixed to the inner surface of the blind box; the iron, therefore, does not turn with the roller. The iron rod is "cambered" or bent upwards, in most instances, for a purpose which will be explained presently. In order to prevent the barrel moving sideways on the rod, two collars are fixed upon it. The ends of the barrel in the case of most outside blinds are closed by turned blocks of beech (Figs. 86 and 87), which should be well seasoned. In order to secure this, the blocks should be cut out in the rough, rather larger than required, a hole bored through, and then kept either square or roughly turned, and finished only when perfectly dry; this is of great importance. The larger blocks should be fitted with brass nipples (Figs. 88 and 89), bored to allow the rod to fit just freely in them. The spring is made of "charcoal spring wire" specially drawn for the purpose, and varying in size. The springs can be made by winding the wire on a mandrel or cylinder revolved in the lathe, or by a hand winch, the mandrel being about one-half the diameter of the tin barrel, but the handyman is advised to buy the spring roller complete ready for fixing. The American 'Hartshorn" wood spring roller (Fig. 90) answers all ordinary requirements. It will be understood that one end of the spring is made fast to the rod, and the other to the block which fits in the end of the wood or steel barrel. In all cases the spring must be so made and fixed that the drawing down of the blind

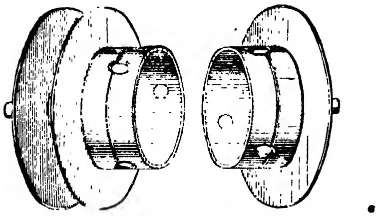


Fig. 84.—Brass Sheath Ends for Roller Blinds.

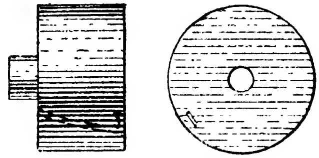


Fig. 86. Fig. 87.

Figs. 86 and 87.—Beech Block to close End of Spring Blind Roller.

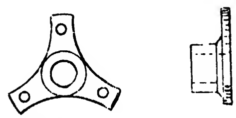


Fig. 88. Fig. 89.

Figs. 88 and 89.—Brass Nipple for Blocks of Spring Blind Roller.

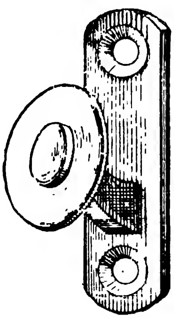


Fig. 85.—Young's Cord Holdfast.

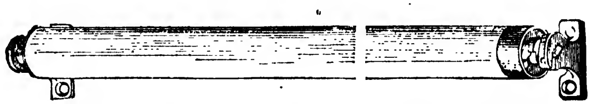


Fig. 90.—American "Hartshorn" Wood Spring Roller with Brackets.

—that is, uncoiling the cloth from the roller—winds up the springs or coils it closer. Inside blind rollers are usually fitted with a rack and cap (Figs. 91 to 93); these prevent the action of the spring from drawing

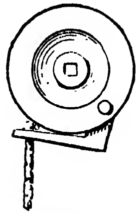


Fig. 91.

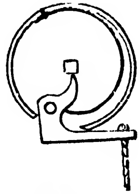


Fig. 92.

Figs. 91 and 92.—Cap for Spring Blind Roller.

the blind up when it is intended that it shall remain down. A cord is attached to the lever, which engages in the ratchet teeth, so that the spring can be allowed to act at pleasure; an arch spring keeps this lever in contact with the teeth at all times, except when the cord is pulled. Fig. 94 further illustrates this, and shows clearly what is meant. Shop blinds, conservatory, studio, and similar blinds, are usually made with spring rollers without the rack and cap. Rollers without the rack and cap must have some distinguishing mark, so that they may be fixed correctly. Such a mark

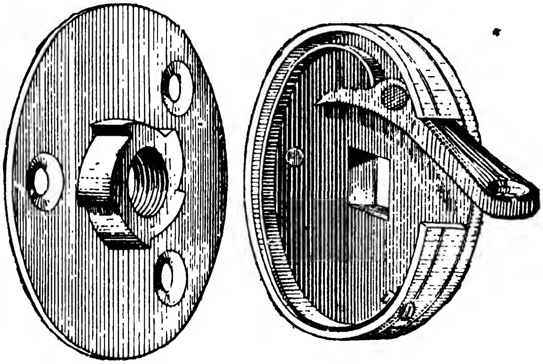


Fig. 94.—Brass Cap and Rack for Spring Blind Roller.

is shown in Fig. 95; it indicates the end where an ordinary—that is, a right-handed—rack and cap would be fixed, such as that illustrated. It is customary to camber all rods more than about 3 ft. long; this is done so that the coils of wire shall not rest upon the inner surface of the lower part of the roller, but upon the iron rod instead. It will thus be seen that the curvature required is slight, being limited by the diameter of the roller, and the necessity

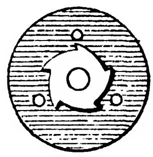


Fig. 93.—Rack for Spring Blind Roller.

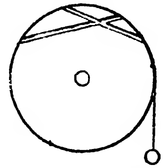


Fig. 95.—Marked End of Spring Blind Roller.

of allowing freedom for the wire thus supported. The ends of the rod must be in line just as truly as if the rod had not been cambered. The fact that a rod is "cambered" is indicated by a file-mark upon the top side of the square end of the rod (see Fig. 96); in the fixed roller this mark must be upwards, or the effect of the cambering will be lost, or rather will be even harmful. For small rollers for inside work, the spring is fixed in a dovetailed notch (Fig. 97), cut with a metal saw, in the rod; this notch is cut downwards about as deep as the thickness of the wire, and widened

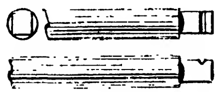


Fig. 96.—Notched End of Spring Blind Roller Rod.

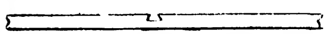


Fig. 97.—Dovetail Notch in Blind Rod for Fixing Spring.

Fig. 98.

Fig. 98.—Charging Iron for Spring Blind Roller.

sideways until the wire will just push into the notch; a couple of blows with a hammer and two or three close twists of the wire round the rod complete the fixing. Assuming a spring roller to be at hand, it

is first of all fitted into the box or bracket fixings intended for it. The spindle or rod must not be constrained endways. If all is right, the cloth may be attached (Fig. 95 will show how it is to go) to a properly marked roller. Of course, rollers having a rack and cap can scarcely be fixed wrongly; the rack and cap shown by Figs. 91 to 93 are suitable for fixing on the end marked

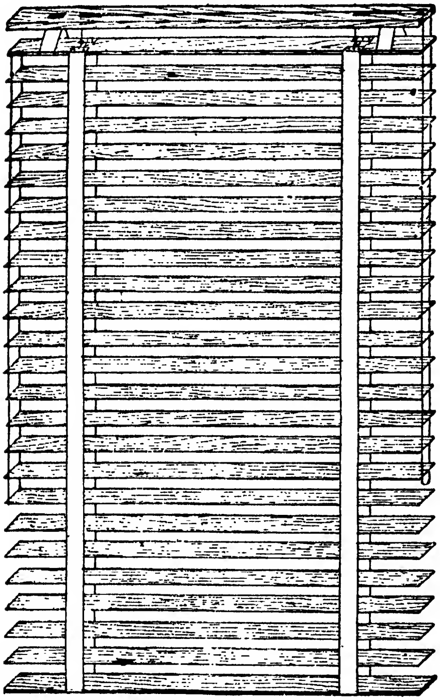


Fig. 99.—Venetian Blind.

with a cross, and are to be to the right hand of a person facing a room window at which it is intended to be fixed. In fixing the cloth, a line is ruled upon the roller, and the blind brought to the line and tacked with wrought tacks to the roller only where the blocks are situated; the rest of the fixing must be done by sewing. If the blind is made to wrap round the roller the reverse way, a pair of folded edges will be produced, so making a nice straight line to sew to, and if the precaution has been taken to wind a strip of web or tick spirally round the rollet, and to sew into it as well as the blind, all will be satisfactory. Charging the spring consists in winding the spring a few turns; drawing the blind down increases the charge, so do not overwind. There are two ways of charging the spring of an outside blind —either the rod may be wound the reverse way with the charging iron, shown in Fig. 98, or its equivalent; or the roller with the blind attached may be put into the place prepared for it, having the blind rolled up smoothly, and a few ties of cord to pr - vent it unwinding; the roller may then be made to revolve in the same direction that it would in unrolling the blind. When it is judged that the spring has been wound enough (six to twelve turns ought to be sufficient), the tick can be affixed to the

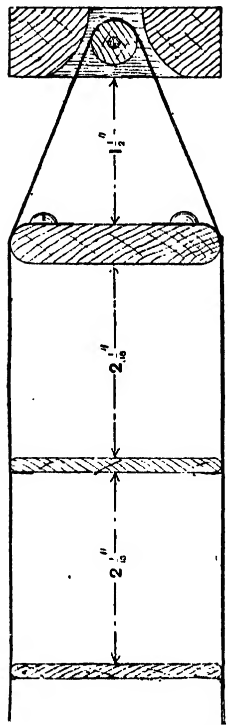


Fig. 100.—Part Section of Venetian Blind.

bottom lath with a few tacks here and there, and the ties taken off. In inside blinds the charging is more easily accomplished, owing to the assistance afforded

by the rack and cap. When rollers have two separate spindles, take care to charge both ends equally, and if removed from the brackets, the roller must be replaced with strict attention to the mark which indicates the top sides of a cambered spindle. A little oil is of benefit to the springs, but any applied to the spindles must be of a non-drying character. It should be mentioned that some of the figures in these pages illustrating blind fittings have been reproduced from the catalogue of Messrs. Tidmarsh and Sons, the well-known Islington firm.

Venetian Blinds.—Fig. 99 shows a Venetian blind open and let down its entire length. The construction is very simple. The top rail is $\frac{3}{4}$ in. thick by $2\frac{1}{4}$ in. wide. The top lath is $\frac{7}{16}$ in. thick by $2\frac{1}{4}$ in., and the length is according to the width of the window for which it is required. The intermediate laths are prepared from clean yellow pine, $2\frac{1}{4}$ in. wide by a full $\frac{1}{8}$ in. thick. They are planed quite smooth and regular in thickness, with the edges slightly rounded, as shown by Fig. 100. For all ordinary blinds, the length from the end of the lath to the cord hole is 6 in., the hole being made in the centre of the lath. The size of the holes is $\frac{3}{4}$ in. by $\frac{3}{8}$ in., the ends being circular (see Fig. 101). These holes are made at each end for the cord to pass through. The bottom lath is not pierced the same as the intermediate ones, the hole in the former being made only just large enough for the cord to be inserted. The cord is then tied in a knot underneath, and when finished is covered by the tape. The top lath is prepared to match the intermediate ones, the cord for applying the louvres being fixed on the opposite end to that from which the blind is drawn, as is indicated in reverse by dotted lines on Fig. 101. The top rail is prepared as shown in Fig. 102. The wheels on which the cord works to draw the blind are made of boxwood, turned in a lathe. They have a hole in the centre about $\frac{1}{8}$ in. in diameter, and are fixed to the rai by means of a wire nail (see Fig. 103). The nail is driven in from one side, and 's so short as not to protrude from the opposite edge. Fig. 103 is a section through B B (Fig. 102). The distance to fix the wheel is determined by the distance from the end of the lath at which the hole is bored. The cord will

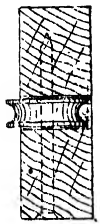


Fig. 103.

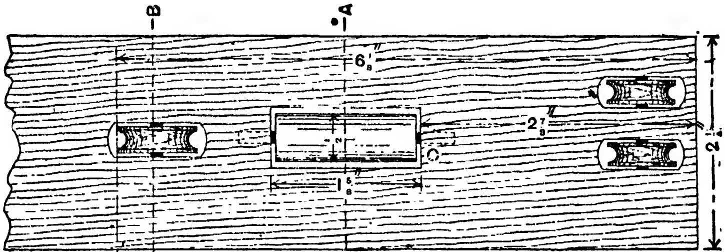


Fig. 102.

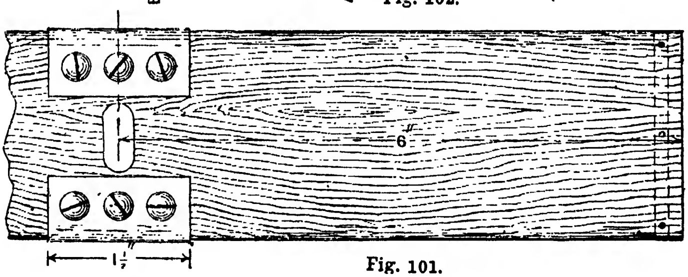


Fig. 101.

Fig. 101.—Part Plan of Top Lath of Venetian Blind.
Figs. 102 and 103.—Part Plan and Section of Top Rail of Venetian Blind.

run over the top and pass directly in the centre of the hole in the laths. The rollers on which the louvres are adjusted are fixed from the top of the rail (see Fig. 102). A nail without a head is driven partly into the rail at C (Fig. 102), and the other end is let into the rail, so that when permanently fixed it lies quite level. Fig. 100 shows a section through A A (Fig. 102). The ladder tape is woven in one piece, the ladders being quite parallel and equally distanced. The proper length of the blind will be obtained by counting the number of spaces; thus, $2\frac{1}{16}$ in. (exclusive of the thickness of the lath) will go into the total height of the opening—that is, from the bead on the sill

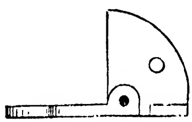


Fig. 105.

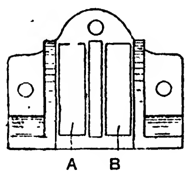


Fig. 104.

Figs. 104 and 105.—Two Views of Brass Checks for Venetian Blind.

to the head of the frame. Figs. 104 and 105 show respectively plan and section of the brass checks that are fixed on to the top of the top rail. The cords pass through the check at A and B. The weight of the blind brings the tumblers into action, and so keeps the blind in position. The cords are released in raising the tumblers by pulling a counter-cord. Information on colouring Venetian blinds is given in a paragraph to be found later in this book under the main heading "Painting."

Blotting-paper

Blotting-paper, which, besides removing wet ink marks, is of use in removing dry ones providing they are made with ferric ink, is prepared by immersing porous white paper in a solution of 1 part of oxalic acid in 4 parts of alcohol, the paper being afterwards hung up to dry. The dry ink marks are moistened with water and the blotting-paper is used in the ordinary way.

Blues

Laundry Blue.—The constituents c laundry blue are the ordinary artificia ultramarine blue and some binding materia preferably glycerine. The blue should b mixed with sufficient glycerine, diluted wit an equal volume of water, to form a mode ately coherent powder, not a paste. Th mass should then be put in moulds an submitted to great pressure to form th cakes. One advantage of the glycerine i that it always retains moisture, and the blu cakes have a deep blue colour much darke than the powder.

Liquid Soluble Laundry Blue.—Solubl blue for laundry use dissolves freely i water when properly made, and such solu tions are sold as liquid laundry blue. Th water must be free from mineral substance especially lime, or precipitation may occu Rain water or distilled water and a goo blue should give a stable preparatio The solution should be filtered throug several thicknesses of fine cotton clot before being bottled; or, if made in larg quantities, it should stand some days t settle, the top portion being then syphone off for use, and the bottom portion can b filtered. The soluble blue is said to b potassium ferri-ferrocyanide, which can b bought ready made, or can be prepared a home by gradually adding to a boilin solution of potassium ferricyanide (re prussiate of potash) an equal quantity o hot solution of ferrous sulphate, boiling fo two hours and washing the precipitate o a filter until the washings assume a dar blue colour; the moist precipitate ca then at once be dissolved by the furthe addition of sufficient water. About 6 parts of the iron salt are necessary to conve 100 parts of the potassium salt into the blu compound.

Blueing Metals (*see* Bronzing Brass Bronzing Copper, etc.)

Boilers

Cementing Boiler with Red-lead.—Repair ing a boiler with red-lead is not a usua method, but was adopted, as described in a American technical paper, in the case of a old boiler with a leaky seam, not wortl

spending much money on. Two 1-in. holes were drilled through the butt strap of the joint with a flat-ended drill, care being taken not to damage the shell itself. The holes were threaded to the bottom with a set of gas taps, spacing the holes twice the distance apart that they were from the extreme ends of the leak. A quantity of red-lead putty, smooth as oil, free from grit, and not too tacky, was made ready. A bar of round stock was threaded to suit the holes, with a square end to take a double wrench. The apparatus was subsequently known as "the putty pump," and was used as follows :—One of the holes was half filled with putty and the bar screwed down with the wrench ; this was repeated with each hole alternately until no more putty could be squeezed down. Around the seams and between the plates the putty could be seen squeezed through. Two plugs were then screwed hard down to their taper threads and cut off flush, thus making a neat job.

Cementing Gourmet Boiler.—For a recipe for a cement for mending a broken Gourmet boiler, try (1) mixing white of egg to a paste with powdered unslaked lime, and apply to the cracks immediately. (2) Powder some glass extremely fine and mix to a paste with the requisite quantity of silicate of soda (water-glass). If the boiler is not merely cracked but broken, then, after cementing, the parts should be held together by binding round them some tinned-iron wire.

Cementing Range Boiler.—" Etna " cement (Verity and Co., Call Lane, Leeds) is said to be suited for mending a cracked range boiler. The following might also be tried : Take two parts of sulphur and one part (by weight) of blacklead ; melt the sulphur in a pan and stir in the blacklead. It can be worked into the crack in the boiler with a hot iron. A plate afterwards screwed over to protect the part is desirable. It is seldom that anything more than a temporary repair in a range boiler can be made by the use of cement, and it would be better to put in a new boiler. A cement that bears a good reputation for special work of this kind is Purimachos, made by the Purimachos Co., of Bristol. For temporary purposes, the cement of sulphur and blacklead above mentioned can be tried.

Cleaning Copper Boiler.—Scour the copper with a pad of tow or any similar material that has been moistened with sulphuric acid and sprinkled with a little sand ; the pad must be kept well moistened with the acid as long as the rubbing is continued. If a trough of sufficient size is available, the boiler may be immersed in sulphuric acid for a few hours, and then scouring will not be necessary, as the acid will dissolve the oxidised surface of the copper. In either case, after the full surface has been removed, the copper may be brought to a fine polish by scouring with oil and fine emery powder, or with metal polish, and after scouring, finishing off with crocus powder.

Cleaning Greasy Boiler Cover.—Wash the cover several times with a sponge, some white soap, and lukewarm water. Hot water must not be used, as this will remove the paint. When the cover is quite free from grease, wipe it with a soft dry cloth, sprinkle some flour over, and lay it on one side for a while ; then give a final rubbing with a dry cloth or soft dry flannel.

Cleaning Range Boiler.—The usual method adopted in cleaning out boilers at back of range fires is as follows :—First expose the lid of the boiler, which is beneath the hot plate behind the fire. With some ranges there is a loose part to the hot plate, which can be removed to expose the lid, but, with others, it is necessary to dismantle the range more or less. When the lid is clear, unscrew the bolts with a screw-hammer or spanner, and then loosen the lid by driving a chisel under it very gently. Assuming it is hard lime deposit that is to be removed, chip it all off with a hand chisel. Now clean off the old packing material from the lid, and, after putting new packing on, bed the lid in its place and screw up. The parts of the range are replaced, and the fire lighted, to see all remains sound when the water is hot. Of course, the apparatus is emptied before the boiler is opened, and refilled after the lid is secured again. The best packing material for the lid is an indiarubber collar, which can be had, cut to order, for about a shilling. Or red and white lead can be mixed to the consistency of putty ; this, with some strands of hemp, makes a watertight joint.

Corrosion in Steam Boilers.—Corrosion is the gradual eating or consumption of the plates owing to the action of acids in the water or to electrolytic action. It often occurs in boilers which use the same water continuously from the surface condenser. To prevent it, the feed water is rendered alkaline by the addition of soda, and rolled zinc is metallically connected with the inside of the boiler, so that no portion of the boiler is much more than 6 ft. from the zinc. This zinc wastes and must be renewed when necessary. If the boiler is standing, soda may also be added to prevent corrosion. About 5 lb. of common soda per 10 cub. ft. of water is sufficient. To prevent corrosion on the outside of the boiler the latter is lagged and painted. "Pitting" explains itself as a local corrosion.

Cutting Boiler Gauge Glasses.—These glasses are cut by a machine made for the purpose; but the simplest way is to tie string, which has been saturated in paraffin or similar oil, round the part which is to be broken and then set it alight. When the string has burnt out, and while the red-hot ashes are on the glass, it must be plunged in cold water, when it will immediately break exactly where it is wanted. (*See also* "Glass: Cutting Glass Bottles.")

Jointing Manhole of Range Boiler.—The best way of jointing the manhole of a high-pressure range boiler is to use an indiarubber collar, which can be purchased ready made in all sizes. These collars are clean to use, quick, and need no preparation. There are no such failures as occur with an evenly made red-lead joint, and any slight leakage can be made good by tightening the nut. There is, however, one fault with the rubber joint: the rubber softens when first heated and requires tightening up again, so that after the joint is made the water must be run in and the fire lighted before the workman leaves the job. If rubber is not used, recourse must be had to red and white lead and hemp. A putty is first made by mixing moist white lead and dry red lead to the consistency of ordinary glazier's putty. A little of this is thinned with boiled oil to make a thick paint, and kept separately. With this the surfaces of the boiler and lid, where the joint comes, are first painted. The putty, with strands of hemp bedded in it, is then put on the lid, and, when the latter is in position and tightened up, a sound joint is the result. Some workers prefer to chop the hemp up and thoroughly mix it in with the putty. A piece of the mixture is then taken and rolled into a rope shape with the hands. It is coiled on the edge of the lid and then put on the boiler and tightened up. Another way is to use a collar of soft card-board, soaked in oil, in place of the coiled hemp.

Leak in Cast-iron Boiler.—Usually it is not of much use trying to stop a leak in a cast-iron boiler by patching it. If the leak is confined to a small area, the faulty place can be drilled out, tapped, and a plug screwed in. This makes a lasting job. It is necessary to make sure that the leak proceeds from a hole, for the spot where the moisture or drip is visible may not be the point at which the leakage occurs. It may be at a joint, and in this case it can be stopped, perhaps, by tightening up the bolts.

Preventing Scale in Steam Boilers.—Soda to prevent steam boiler scale is being used largely; the soda most suitable for the purpose is that known as "58 per cent ammonia soda," this being the purest soda made. When the boiler has been emptied and refilled, add just enough soda to turn the water slightly alkaline—that is, to just turn red litmus paper blue. Whilst the boiler is working, draw off from the tap a little of the water two or three times a day, and test it with red litmus paper, which should turn blue; if it does not do so, add soda. Once a day, or oftener if the water is hard, draw off the water from the lowest draw-off cock until the water level falls half an inch as indicated by the gauge; by this means much of the deposited lime is run off and the time for clearing out the boiler is delayed.

Repairing Galvanised Iron Range Boiler.—For repairing a range boiler of galvanised iron too thin to be tapped and stopped with a screw plug, where the boiler leaked a perfectly round hole was made to take a $\frac{1}{4}$-in. bolt with a soft copper washer on the inside. The bolt and washer were secured together and dropped by a thread

into the boiler through the hot water opening at the top; a piece of thread also hung from the bolt, and it was a simple matter to insert a wire through the hole and catch this hanging thread. The bolt was then drawn through the hole, and another soft copper washer placed on the outside. A cement composed of litharge and glycerine was worked into the hole between the inside of the boiler shell and the washer, and some of the same cement was put on the outside of the boiler shell under the washer. Then the washers were drawn up tight against the shell by the nut. When the cement had hardened the joint was found perfectly tight, and has since stood for a considerable time. This method has been found serviceable for stopping holes in iron tanks, pipes, etc., where replacing the material would have caused considerable expense.

Rusty Boilers.—Copper boilers are generally used where the water is soft, because of the difficulty in keeping iron boilers from rusting. Even galvanising iron boilers is of no use, as soft water attacks zinc just as freely as it attacks iron. Rain water and all soft waters attack iron somewhat vigorously and usually cause iron boilers and pipes to discolour the water contained in them. Hard water is free from this fault, and the presence of lime in the water accounts for the difference. The remedy is first to scrub out the boiler so as to remove as much rust as possible. Mix some freshly slaked lime with water to the consistency of thin cream, adding a little size as a fixative. When the boiler is clean and dry, well rub in a coat of the limewash. Let this dry, then give another coat, and, on this drying, the water may be turned in. This may prove a permanent cure, or the operation may require to be performed once or twice a year. This limewashing amounts to artificially furring the boiler, and furred boilers give no trouble with rust. Lime is an active opponent to the rusting process.

Boiling White (*see* Tinning)

Bone

Bending Bone.—If the bone is not very thick, prepare a solution of common washing soda and water, and heat to boiling point. Immerse the bone, and boil for thirty minutes; then, assuming it to be a bone mouthpiece, push through it a piece of soft steel wire the size of the bore of the bone, bend to the required curve, and withdraw the wire, leaving the bone to set. If the bone shows a tendency to go back to its original curve, bind a bit of soft doubled wire round each end, slip a bit of wood or metal between the strands, and screw tight after the manner of the "stretcher" of a bow-saw. Thick bone should be immersed in phosphoric acid, which may require dilution. To soften bone and ivory of moderate dimensions, phosphoric acid is poured into a flat glazed dish, and the material is placed therein exposed to the air. Experience alone will determine the length of time required, but the articles should be taken out of the bath from time to time, washed in clean water, and tested for softness.

Bleaching Bone.—Previous to the bleaching proper, the bones should be boiled in a solution of soda to remove the grease, after which they may be placed in an earthenware pot and covered with a mixture of equal volumes of hydrogen peroxide and dilute ammonia. If the earthenware pot be now placed in a warm situation the bleaching will proceed rather rapidly, a final washing in water being all that is required. A mixture of equal parts of ammonia (weak) and hydrogen peroxide, followed by clear water, may be used as baths for bleaching bone.

Cleaning Bone.—Stains partly due to fat or grease can be removed by soaking the articles for twenty-four hours in benzene, and allowing to dry slowly. Many other stains and discolorations can be removed by steeping the bones in a solution of hydrogen peroxide to which a little ammonia has been added to render it alkaline, as shown above.

Hardening Bone.—Bones can be hardened and the soft pores closed by soaking for a week or two in a solution of silicate of soda 1 part and water 3 parts, and then for a similar length of time in chloride of calcium solution 1 part and water 3 parts. The process could no doubt be hastened by boiling the bones alternately in these liquids. It will be best to rinse the bones in water after the

first treatment and before putting them in the second solution, otherwise there will be formed on the outsides of the bones a deposit which will render them unsightly in appearance.

Whitening Bone.—Bone has a great tendency to become yellow, both by use

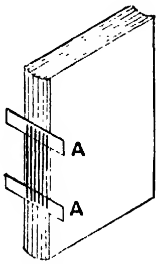


Fig. 106.—Book Sheets being Sewn to Tapes.

and by exposure to the atmosphere. For commercial and artistic uses the bones are steamed at a very high temperature, and in this way all the fatty matter contained therein is extracted. After the bone is dressed with file and scraper, polish with a revolving brush with whiting and water, and finish in the same way with dry whiting.

Books

Binding Books without Tools.—For binding books without tools all that need be provided is a little melted glue, some paste, a needle and stout thread, some white and coloured papers, and a few other trifling items. Arrange the sheets to be bound in order, beat them even at the back and head, and subject them to a heavy pressure between two flat surfaces by piling weights on them. Now take two pieces of tape ½ in. wide, and each 2 in. longer than the width of the back of the book. Stiffen the tape by drawing it through paste, and then let it dry before use. Fold the pieces of stiff tape, and place the sheets within them in such a position that the two tapes A (Fig. 106) will divide the back into three equal lengths. While the sheets are pressed down firmly with the left hand, with a lead pencil draw a line down each side of the tapes, and two other lines, each one dividing that part of the back outside the tapes into equal portions. These lines mark the place for the entrance of the needle. The sheets are to be sewn on the tapes as in Fig. 106. When the book is sewn, the threads fastening each sheet are seen outside the tapes. The back must now receive a coating of glue, not too thin, after which it may be left to dry. Then, the glue being hard, the book may be cut on the edges with a straightedge and a sharp knife. The back must next be rounded by tapping with a hammer, which may be helped by a gentle pulling at the tapes. For the covers, use the thinnest millboard. Cut two pieces of this to project about ⅛ in. over the head, foot, and fore-edge of the book, and glue them in position on the projecting tapes, which will adhere to their inner sides. Over the tapes glue strips of coarse canvas B (Fig. 107), each strip being 1 in. wide by 6 in. long; then glue on the open back. When this glue is dry the volume may be covered with paper, cloth, leather, or vellum. Vellum must be lined first with clean white paper firmly pasted on it, and cloth covers must be fastened with glue; instead of gluing the tapes to the boards, cut a cloth cover large enough to allow for overlapping and for the width of the back, glue the covers on the cloth parallel with each other, and turn in the cloth round the edges. When this is dry, the book may be placed in the cloth cover,

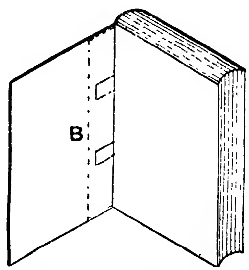


Fig. 107.—Bound Bock showing Canvas Strips Glued Over Tapes.

the tapes glued to the inner sides, the open back to the back of the cloth, and the strengthening canvas glued over the tapes; finally, the end papers being fastened down, the volume is finished. It will look a homely affair, but it will cost little beyond the trouble and will effectually preserve the volume. For many volumes published in

numbers the publishers supply covers ; these may be securely fastened on by this simple method.

Binding Books with Home-made Tools. – Below is described the method of case-binding, that is, the binding of serial publications in the covers specially issued for them. To make the sewing frame (Fig. 108), obtain a smooth board about 2 ft. by 1 ft. 6 in., and on the long side, 3 in. from each end and 1¼ in. from the edge, cut a slit A about ½ in. wide. Now get two pieces of wood 1 ft. long by 1 in. square, and nail them upright, one at each end of the slit ; and across the uprights secure another of equal thickness. For making the press (Fig. 109)

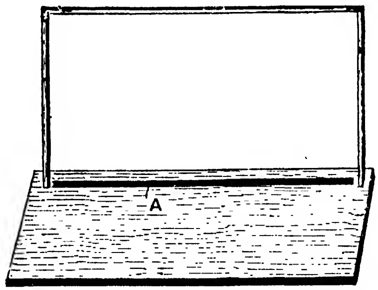


Fig. 108.—Bookbinder's Home-made Sewing Frame.

two pieces of wood 2 ft. 6 in. long by about 5 in. square will be required ; also two bench screws, which can be bought for half-a-crown. The lengths of timber are to serve for the cheeks of the press, and a hole must be bored in them, about 2½ in. from each end, large enough to admit the screws. To pass the screws through the holes, it will be necessary to remove the small blocks of wood containing the thread on which they turn. These are afterwards screwed on again and nailed to the press, which screws up quite easily, and with the press pin can be tightened as firmly as required. A stand like that shown in Fig. 110 will be required for the press. A strong box will serve the purpose admirably. It should be strongly made of lengths of wood 2 in. or 3 in. thick. Several pairs of backing boards will be required, varying from 9 in. to 1 ft. 6 in. long by 4 in. wide, and about ½ in. thick ; the use of these will be explained later. Any ordinary hammer will do for this work, but the larger the head the better. A saw with very small teeth will also be wanted. The glue pot and brush need no description. The glue is broken into small pieces, placed in the jar, and covered with water. It is allowed to soak all night, and then the jar

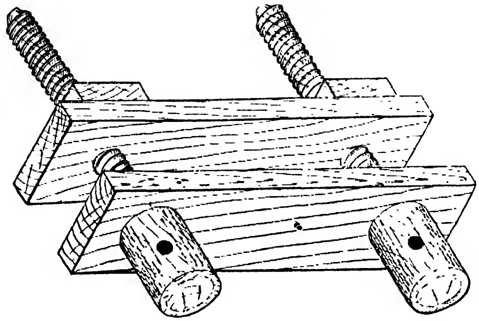


Fig. 109. –Home-made Lying or Laying Press.

may be placed in a saucepan of water and put on the fire to boil. Some good adhesive paste will also have to be made. White paper, which is used for end papers or fly leaves, can be bought at the stationer's at about sixpence a quire. An ordinary darning needle and a skein of strong thread complete the outfit. The tools and materials all being ready to hand, the work of binding may be begun. Having placed the numbers

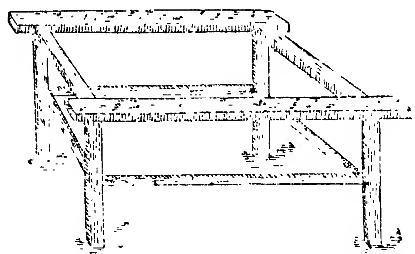


Fig. 110. Stand for Bookbinder's Press.

in proper order, detach the covers and the advertisements, and take out all wires ; then dissect the numbers section by section. Next place the numbers between the backing boards, and knock them together on the press until all the sections are level. Then screw them up in the press, leaving the

backs sticking out three or four inches. Right across the back, and exactly in the centre, make an incision with the saw about $\frac{1}{10}$ in. deep; two more an inch or so

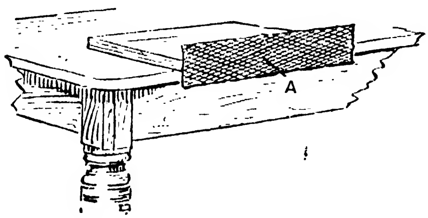


Fig. 111.—Linen Pasted on Back Edge of Paper-backed Book.

from each end; and then two others at equal distances between the centre and the end. These saw-kerfs should be just large enough to receive and hide the cord. The book is now ready for sewing. Three pieces of cord or twine are fastened to the bar of the sewing frame, brought through the slit, and secured underneath. They must be so arranged as to fit into the saw-kerfs. Find the centre of the first section of the book, and place it level with the strings, and commence sewing by pushing the needle through the first hole and out at the next, round the string, and in again at the same hole, out at the third round the string, and in again, and so on until the first section is secured firmly to the strings. Then place second section in position, sew back again in precisely the same way, and tie the ends

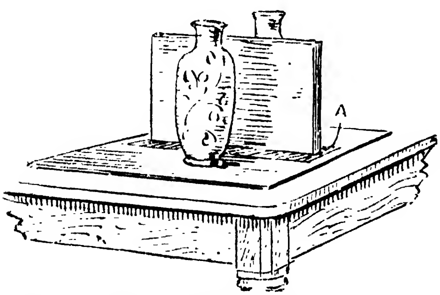


Fig. 112.—Book standing on Pasted Calico.

of the thread. Repeat the sewing with each section until all are secured to the strings. When one needleful of thread has been exhausted, the needle must be re-threaded, and the ends tied. The book must be sewn with one continuous thread, and care should be taken that all knots are securely tied. The volume when sewn is removed from the frame by cutting the strings. The end papers or fly leaves must now be added. Fold a sheet of white paper of the right size, and with a very thin streak of paste along the folded edge affix it to the first page of the book; another sheet is folded and pasted in the same way to the back page. They are then left to dry. Any local printer will trim the edges of the book, to make it fit the case, for a few pence. After the edges have been cut, brush a thin coating of glue over the back; and when it is nearly dry, lay the book on the top of the press with the back on the farther side. Now hammer evenly along the back, steadying the book with the left hand; then turn the volume over and repeat. Continue this

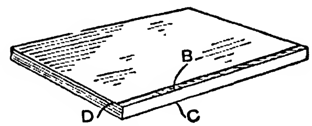


Fig. 113.—First Cover Trimmed in course of Binding Paper-backed Book.

operation until the volume presents a round back and a concave fore-edge. The next process is to back the book. Place the backing boards just under $\frac{1}{4}$ in. from the back of the book, one on each side, and screw firmly into the press with as much pressure as possible. The sections are then knocked over with the hammer, until they reach the backing boards; it requires a little practice to do this evenly and well. When the book is taken from the press, it will be seen that the last process has produced a ridge, into which the cardboard covers are made to fit. Examination of any bound book will make this clear. Cut off the strings quite close to the back, and return the book to the press, leaving the back standing out 2 in. or 3 in. A strip of linen almost as long as the book, and 3 in. wider than the back, should now be cut. Glue the back of the book again, and put the linen on so that an equal portion overlaps on each side; and over this glue a piece of brown paper the same size as the back.

The book is now ready for fixing into the case. Leave an equal margin of cover all round, and paste the linen and the first sheet of white paper to the inside of the cover, at both the beginning and the end of the book. It should then be put into the press immediately, and left until thoroughly dry, when the volume is bound complete.

Binding Paper-backed Books.—Many cheap editions of books, especially of music books such as oratorios like the "Messiah," etc., are published in paper covers. With constant reference these covers soon become somewhat dilapidated, but if bound in brown paper the covers are strong, and the backs are limp, allowing the books to be rolled. In beginning to bind, first cut off the front covers and backs, but keep them, as they will be wanted. Next, on the back edge glue a piece of linen

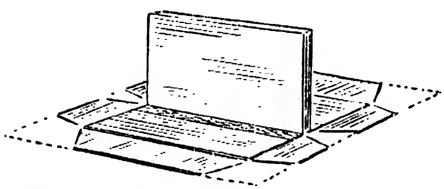


Fig. 114.—Securing Second Cover to Book.

or calico a little longer than the back of the book and 2½ in. wide. Take care there is no loose paper on the edge, and press the glue well in—see Fig. 111. When this is dry, take a piece of brown paper a little larger than the book when open, paste (do not glue) the calico A, and place it on the brown paper, as shown in Fig. 112. Ornaments or anything else suitable will keep the book in position. When dry, bend the paper backs on the leaves of the book, keeping the edges sharp on the back, as at B and C (Fig. 113), and with a knife cut off the projecting paper nearly level with the leaves. Next cut a piece of brown paper about 4 in. larger all round than the book when open, and paste the whole surface of one side; also paste the two new outsides and back edge of the book, place the book on the big sheet, and cut pieces away, as shown in Fig. 114. Next turn the flaps over, as in Fig. 115, and then, when dry, to make a finish inside, paste white or tinted paper inside the covers, leaving about ⅛ in. margin all round. When dry, bend the covers on to the leaves, again keeping the edges B and C sharp. Now trim the edges of the printed title-cover and

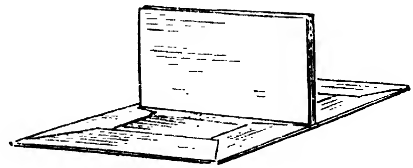


Fig. 115. Second Cover secured to Book.

paste it on the front brown-paper cover, and treat the back in the same way, if it is sufficiently ornamental. Do not open the covers till they are quite dry, and then make an indentation about ⅛ in. from the edge with the thumb-nail, as D (Fig. 113). Then bend the covers over, as shown at D (Fig. 116). This will prevent the backs leaving the binding, as when the backs are opened the part which is glued to the leaves is not affected. To make a finish, the name and volume should be written on the back edge, as in Fig. 116. Thin bookbinder's cloth or American cloth may be used if a more durable binding is desired. The success of this method of binding lies in not being in too great a hurry to proceed from one stage to another—that is, in not beginning before the parts are thoroughly dry, and thus destroying the neatness of the job.

Book Covers, Cleaning and Reviving.—To clean up the covers of books, whether bound in calf or morocco, the following method may be employed. Obtain a piece of Para rubber; if this is not soft, heat it

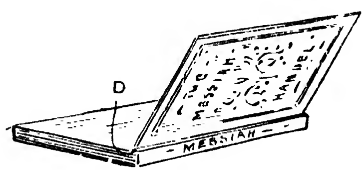


Fig. 116.—Book in Binding, Complete.

over the fire or gas, for hard, square edges would produce scratches on the covers. With this rub over all the gilding on the backs and sides, gently at first and a little harder

afterwards; this should make the gilding clear and bright. Now prepare some paste-water, mixing flour with water till it is as thick as good milk. With this wash over the leather, using a sponge. Take care not to touch the cloth or any of the gilding. To clean the cloth sides, beat up in a dish the white of an egg until it becomes a solid mass of dry-looking froth; allow this to settle into an amber-coloured liquid (glair), and with this wash over the cloth. Have plenty in the sponge and work quickly in a circular motion, taking care not to go over the same part twice. For some cloths a weaker solution must be used, so add as much water as will make twice the quantity. If this glair is not properly beaten up, the sides of the book when dry will have a nasty glaze, which will turn white and spoil the appearance. To remove scratches in morocco, if the skin is not broken, damp the part with hot water, and beat with a clothes-brush, holding it by one end and beating with the point of the other; this will raise the grain, and if the scratch is slight the effect desired will be gained. If not, while still damp, take a fine sewing needle and with the point carefully lift the leather in the scratch, working with the grain, and afterwards damp again and use the brush. If the skin is broken, use the needle and pick up all the edges of the scratch on both sides, rub in a little thin paste, and lay down the edges, using the needle so that each little piece may be carefully replaced in position. Rub off any surplus paste with the sponge. When dry go over it with the needle, stroking where necessary with the grain of the leather. For calf, instead of the needle and brush use a bone folder or handle of a tooth-brush. Damp the part first with hot water, rub on a little paste with the finger, and rub well with the folder, taking care to keep it flat or more marks will be made. Wash again and allow to dry. Repeat the operation if necessary. If the skin of calf has been broken, the method of pasting down must be employed, using the folder instead of the brush.

Book Covers, Removing Labels from.—The only successful method of removing labels from the backs of books is to soak the labels thoroughly with water. With leather-bound books there should be no difficulty, because clean water does not injure the leather. Apply clean hot water carefully and freely to the label, using a small camel-hair brush. Allow the water to soak thoroughly, and the label will peel off without tearing. The gum left can be wiped off with a sponge. Cloth-bound books may be treated similarly, but the water must not be allowed to touch the cloth. When the label is removed, wipe the entire back with weak glair (see the end of the paragraph below: "Book Covers, Removing Stains"). If the work is done carefully, there should be no mark left where the label has been.

Book Covers, Removing Stains.—Glue stains on paper covers will have to be scraped or chipped off. When the binding wires have been removed, the sections can be easily taken apart. The best tool to use is a blunt table knife. Lay a section flat upon the table, with the fold to the right hand. Hold it in position with the left hand; then take the knife in the right hand, and, placing it almost flat upon the section, work the blade outwards to the fold; by this means the glue will be chipped off. Turn the section over and treat in the same manner. Then lift the section up and draw it through the fingers. The details may have to be varied a little according to the quantity of glue that has to be removed. The knife only must be used, and care must be taken not to cut or tear the sections. It is rather a hopeless task to attempt to remove oil stains from a book cover. The following method may, however, be tried:—Make up a pad of a few pieces of good blotting-paper. Lay this over the stain, and press on it a hot flat iron. Continue this treatment for some time, occasionally lifting the blotting-paper to examine the spot. Care must be taken that the heat from the iron does not injure the cover. Now make a small pad of cotton-wool, well soak it with benzine, and with this wash the entire cover, taking care not to rub or to apply the benzine in patches. Let the washing be done with broad, swift strokes from side to side of the cover, and from top to bottom. When washed, allow to dry thoroughly. When the benzine is applied, the cover will

probably look black, or very much darker than it was originally, but this will pass away, and with it possibly the oil stain. When using benzine, keep it well away from artificial light or fire, as it is highly inflammable. Use it in a cool room in daylight. After the cover has become dry, it can be washed again and again. A cloth cover marked with water stains can be greatly improved if washed over with glair, which is made as follows :—Break an egg over a jam-pot, and allow only the white to fall in, keeping back the yolk. Beat it up into a dry froth, and allow to settle. Add about ½ pt. of water, and wash over the books, using a sponge, and allow to dry. This, although not removing the spots, will render them less unsightly.

Book Edges, Gilding (*see* Gilding).

Book Leaves, Removing Stains.—When ink stains are of long standing, it is doubtful whether they can be removed, but the following may be tried. Make a solution of chloride of lime and a solution of oxalic acid in separate bottles. The strength is immaterial ; about one pennyworth to a pint of water for each will do. Take a sheet of clean white blotting-paper the size of the book-leaves, and on it lay one of the stained leaves. Mix about equal quantities of the above solutions in a saucer. Saturate a small piece of soft sponge or cotton-wool in the solution, daub it carefully over the stains so that the paper will become thoroughly wet through, then allow to dry, if possible in the sun. Do one leaf at a time, and if the stain has not been removed with the first application, repeat again and again. This will have no detrimental effect on the printing whatever, but the paper will be spoiled if it is rubbed while applying the solution or while damp. The above may be tried for tea stains as well. With regard to slight paint stains, if turpentine does not remove them, try a mixture of alcohol and chloroform ; but before doing so, place several thicknesses of blotting-paper below the leaf to prevent other pages being stained. If this does not remove them entirely, try rubbing gently with a piece of soft bread.

Paste, Bookbinders' (*see* main heading, Paste).

Re-casing Books.—It is here described how to treat books bound in publishers' covers which have become loose and untidy through usage, it being required to take them out and put them back again in the same covers. Ordinary cloth-bound books are never very strongly bound, and in a short time begin to show signs of wear. When in this state, the best remedy is to take them out of the cases or covers, re-sew them, and return them to the original cases. This work is well within the range of the amateur bookbinder. Turn both boards back from the book as shown in Fig. 117, and cut down the joint at A. The knife used should be sharp, as it will have to cut through the tape or cord on which the book has been sewn, and also the lining of the back. But care

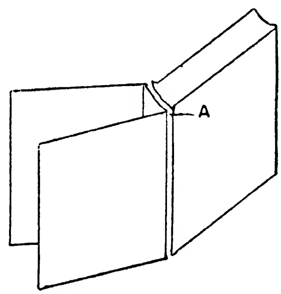


Fig. 117.—Removing Leaves of Book from Case.

must be taken not to cut the case. Lay the case aside and take the book to pieces. This operation is called "pulling" or "taking" down. Lay the book on the bench or table with the back to the left hand and the front upwards. Separate the half of the end paper carefully from the book, and retain it, as it will be used to keep the book clean. Turn over the leaves until the first signature mark is seen. This will probably be found at the bottom right-hand corner of p. 1 of the book proper (the title-page and prefatory matter coming first), and will either be the letter B or the figure 2. Grasp these pages tightly in the left hand, and while bearing on the remainder of the book with the right hand, pull them outwards, when the stitches will be exposed. Cut the stitches carefully, and the sheet will come away. Open this part, which has been cut

away, in the centre, and clear out all the threads. Close the sheet again and scrape the glue from the back. Lay this portion aside at the left hand, with the front downwards. Then turn over the book again until p. 17 is reached; the signature mark will be found here in the same position. This time it will be C or 3. Cut this off as before, and go through the entire book, cutting and removing the threads, always looking for the signature before cutting. Books are not all made up in the same way. Some have their sheets folded into 16 pages, and others into 8 or 32 pages. But they all have signature marks, and these are generally found at one of the bottom corners of the proper page. Each sheet as it is cut and scraped is laid on the top of the former with the back of the sheet upwards, so that

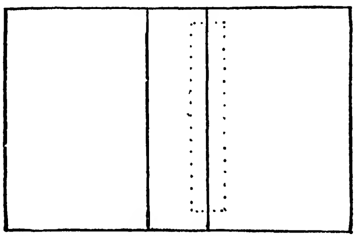


Fig. 118.—Repairing Case of Book.

when the book is all taken to pieces, it will be in proper order. The halves of the end papers are also laid one on the front and one on the back to keep the book clean. Do not attempt to tear away the tape or lining of the back. If it is found to be a hindrance while taking down the book, cut it away in pieces as the work proceeds. If it is forced away the book will be torn. The back of the sheets will be found to be bent more or less. This is called the joint, and it will have to be hammered off or flattened. Take up the first few sheets and hammer them along the back with a bookbinder's large-faced hammer while they are on the bench. Proceed until all the book is hammered quite flat. When this is done the book will be ready for sewing. It may be sewn on cords or tapes as desired. After sewing, a pair of end papers are attached, and the back is glued. When the glue is nearly dry, the back is hammered to make it round. It is then put into the lying press (se Fig. 109) between two boards called jointin boards, and the back is hammered over th boards so as to make the joint. Now tak the case and clean it from all loose pieces o paper or tape which may be found on th inside of the boards. Make it as clean an smooth as possible. It may also be torn at th joint. In mending this, do not attemp to sew it by drawing the torn pieces togethe The proper method to adopt is carefully t lift up the cloth on the back and the side If a table knife is used it can be slippe underneath, and the cloth raised withou further tearing. When this is done, a piec of bookbinder's cloth is cut to size, glued and inserted under the cloth of the case and this again glued down on top. Fig. 11 shows this clearly, the dotted lines indicatin the patch. A strip of brown paper shoul also be glued over the whole back of the case This will, of course, strengthen it greatly The book is now again taken in hand. I it has been sewn on tapes, these are glued o pasted down to the sides of the book. I sewn on cords, the cords must first b scraped thin and pasted on the book. A piece of muslin or mull is cut ¼ in. shorte than the back of the book, and 1 in. broader The back of the book is glued and the musli put on, allowing ½ in. to overlap on the sides This is rubbed down carefully to make i adhere well to the back. Over this linin glue a strip of brown paper, which must no overlap on the side. Now fit the book int the case. Open one board and glue the en paper, taking care that the glue is put unde the muslin as well as over it. Close thi board carefully and turn over the book, an repeat the operation on the other side Place the book between boards, and then int a press, or lay heavy weights on it and leav it to dry.

Boots and Shoes

Black Canvas Shoes, Re-dyeing.—To re-dye a pair of black canvas shoes that hav worn white, well wash the shoes and le them dry, then apply one or two coats o a solution made as follows:—Half fill a half-pint bottle with methylated spirit an then add 1 oz. of extract of logwood (2d. and twopennyworth of tincture of steel

When dissolved, fill the bottle up with water. Shake well before using.

Black Finishing Ink.—The following are recipes for making a quick-drying black ink for finishing boots:—(1) One pint of alcohol, 1½ oz. of tincture of iron, 1 oz. of extract of logwood, 1 oz. of pulverised nut galls, ½ pt. of soft water, and ½ oz. of sweet oil. The oil must be mixed with the alcohol before adding the water and other ingredients. (2) Soft water, 5 gal.; bring it to a boil, and add 8 oz. of pulverised logwood extract, keeping it on the fire for three minutes only; then remove, and stir in 2½ oz. of gum arabic, 1 oz. of bichromate of potash, and 80 gr. of prussiate of potash. (3) Soft water 1 gal., extract of logwood 1 oz.; boil till the extract is dissolved, take from the fire, and add 2 oz. of copperas and ½ oz. each of bichromate of potash and gum arabic, all well powdered.

Black Polish, Liquid.—(1) Boil together in a pipkin, 1 pt. of linseed oil, ½ lb. of mutton suet, ½ lb. of beeswax, and a small piece of resin. When the mixture becomes lukewarm, apply it with a soft hair brush. After two applications the boots will become waterproof. Great caution must be observed in mixing, as it is very inflammable. (2) 4 oz. of gum arabic, 1½ oz. of treacle or coarse moist sugar, ¼ pt. of good black ink, 2 oz. of strong vinegar, 1 oz. of rectified spirits of wine, and 1 oz. of sweet oil. Dissolve the gum in the ink, add the oil, and shake together until they are thoroughly mixed; then add the vinegar, and lastly the spirit. Keep in a tightly-corked bottle. (3) ¾ oz. of lampblack, 1 dr. of indigo in fine powder; put into a mortar and mix. Rub them together with a mucilage made by dissolving 4 oz. of gum arabic in ¼ pt. of strong vinegar to form a thin paste; then add gradually 1 oz. of sweet oil, and stir them together until thoroughly mixed. Then add 1½ oz of treacle, and afterwards, successively, 2 oz. of strong vinegar and 1 oz. of rectified spirit, and bottle for use. (2) and (3) are mostly used for dress boots and shoes, and are applied to the leather with a bit of sponge. (4) Mix together 2 pt. of vinegar and 1 pt. of soft water, to which add ¼ lb. of logwood chips, crushed small, ½ oz. of best soft soap, and ¼ oz. of isinglass; mix these ingredients well while simmering over a slow fire until the mixture boils (in ten or fifteen minutes). Then strain through a fine sieve; when cold, the polish is ready for use. Apply with a sponge. These polishes should be laid on as thin as possible.

Black Polish, Paste.—For making a paste polish similar to "Nugget" polish, (1) procure 10 lb. of bone black, 2½ lb. of sulphuric acid, 2 pints of good cod-liver oil, 2 lb. of treacle, 2½ oz. of powdered Prussian blue, and some stale beer. Mix the acid with the bone black and well stir, then add the oil, the treacle, and the blue, and well mix the whole together; finally, reduce to suitable consistency with the beer. (2) Melt 2 oz. of asphaltum and 3 oz. of beeswax in a glazed vessel over a fire, then remove, and stir in two spoonsful of spirits of wine or methylated spirit, ½ oz. of lampblack, and ½ dr. of powdered Prussian blue, with sufficient castor oil to form a paste. Work this well together, and keep in closed tin boxes. Apply with a soft sponge; only a little at a time is required when using.

Blacking, Liquid.—For a really good liquid blacking take of very finely powdered ivory black 2 lb., molasses 1½ lb., sperm oil ¼ pt., and mix well; then add 1 oz. gum arabic dissolved in ½ pt. of strong vinegar or stale beer, and mix this with the former. Let it stand twenty-four hours, then add 3 to 4 pt. more of vinegar, or strong beer; stir briskly for a quarter of an hour, and again once a day for a week. It is then ready for use. Another recipe for best quality blacking is:—Ivory black 15 oz., treacle 15 oz., sperm oil 15 dr., oil of vitriol 15 dr., and common vinegar 2½ pt. Mix the black, vinegar, and treacle together; then the sperm oil and vitriol separately, and add to the other mixture. The following has been given as a recipe for Day and Martin's liquid blacking:—Thoroughly mix together finely-ground animal charcoal, or bone black, and sperm oil. Raw sugar mixed with a little vinegar is added, together with a small quantity of dilute sulphuric acid. The latter gives the mixture a pasty consistency. Vinegar is then added until the whole is thinned, and the blacking may then be bottled.

Blacking, Paste.—(1) Mix 8 parts of ivory black, 4 parts of treacle, and 1 part of sweet oil; then add 2 parts of oil of vitriol diluted with 4 parts of water. Add water or stale beer to produce required consistency. (2) Melt together mutton suet 2 oz., pure beeswax 6 oz., fine powdered sugar candy 6 oz., soft soap 2 oz., lampblack 2 oz., indigo in fine powder ½ oz. When thoroughly incorporated, add ¼ pt. of oil of turpentine. Keep in pots or tins. (3) Superior blacking:—Mix together 3 lb. to 4 lb. of lampblack, ½ lb. of animal charcoal, moisten with glycerine, and add 5 lb. of molasses. Melt 2½ oz. of pure guttapercha in an iron vessel over a fire, and stir in first ½ pt. of olive oil and then 1 oz. of stearin. Add the warm mass to the former mixture, and then add a solution of 5 oz. of gum senegal in 1½ pt. of water, and 1 dr. each of rosemary and lavender oils. (4) Rub together 1 lb. of molasses, 1¼ lb. of ivory black, and 2 oz. of sweet oil, and add a little lemon juice, or strong vinegar. (5) Rub together 7 lb. of ivory black, 5¼ lb. of molasses, ½ pt. of common oil, 12 oz. of oil of vitriol, and sufficient water.

Brown Boots, Blackening.—(1) A simple way of blackening brown boots is to take a raw potato, cut it in halves, and rub all over the leather for a few moments, after which rub the blacking well in and polish. This recipe is the favourite one in the British army, where the boots are principally brown when issued. (2) Three-halfpenny-worth of finishing ink (to be obtained at any grindery warehouse) will transform scores of pairs of brown boots into black ones. After two coats, blacking and polishing in the usual way only are necessary. (3) Work the boots all over with clean lukewarm water; then rub them with half of a raw potato, drying them first with a cloth, and just as they are nicely drying, apply the following well mixed in a bottle:—One-pennyworth of essence of logwood and one-pennyworth of tincture of steel, put into a half-pint bottle with one-pennyworth of methylated spirit. Occasionally shake the bottle till the logwood has dissolved, then add an equal quantity of ordinary shoe-maker's ink, which can be obtained of any leather-seller or grindery shop. Shake up well, and apply a coat. If a second or third coat is needed, let the previous one dry before applying the next. (4) Apply a coat of weak ammonia and water, and then one or two coats of shoemaker's ink. When dry, rub in a little neatsfoot oil, or, if the boots have been oiled prior to blacking, apply some stale white of egg. (5) Take ½ pt. of shoemaker's ink, ½ pt. of soft water, a few logwood chips (a little logwood extract is better still), and about a thimbleful of copperas; boil these together till the solution loses about a sixth of its quantity. Apply this to the boots. (6) Well rub into the leather a strong solution (warm) of common washing soda, and while still damp, apply a coat of green copperas solution, not too strong; give the boots two or three coats of this solution till they become thoroughly black, then well rub in with the hand some common beef tallow.

Brown Boots: Cleaning and Restoring Colour.—Brown boots that have become rather soiled may be restored to their original colour in the following way:—First put the boots on boot trees or on the lasts from which they were made; be very careful in putting in the latter, as the leather may have shrunk. If neither lasts nor trees are available, fill the boots with pieces of thin soft paper, pressing each piece in so tightly that a little pressure will not displace it; lace them, and so fill them right up to the top. Now, with a soft clean brush, apply lukewarm water; do not be afraid to let them get wet, and do not let them dry before they are quite finished with. If they are not perfectly free from dirt, give them another coat, with a little yellow soap, and wash this off with water when the boots are clean. While they are wet give them a coat of very weak oxalic acid and water, using the brush freely, but hard. If this is not effective, add a little more acid to the water, and when the colour is as light as is desired, wash the acid off with water and let the boot dry in a cool place. There are several washes sold for cleaning purposes which would no doubt be found suitable, but the acid is cheapest. After the boots are dry, take them off the trees and work them about so as to soften the leather. This will help to lighten them, as it works

the water-stain out. Then give them a good cleaning with white or pale brown boot cream. If they are calf, and not Russian leather, be a little more sparing with the water. For polishing the boots, see a later paragraph.

Brown Boots, Colouring.—After washing off stains with soap and lukewarm water, and when nearly dry, use the following, applied with a sponge: a pennyworth of annatto and a pennyworth of saffron to 1 gill of hot water; this should be applied when nearly cold. This keeps the colour good, and improves the articles. It can be used for all kinds of brown leather goods.

Brown Boots, Darkening.—To darken a pair of light tan shoes, apply two or more coats of Propert's dark stain, and afterwards polish with the darkest brown cream obtainable. If the leather has not been creamed before, a couple of coats of the darkest brown shade of Dolly dye might be applied: cream takes well afterwards. If the shoes have already been creamed, it will be better to tree them and well wash off the old cream and apply the stain (Propert's) when the leather has become dry.

Brown Boots, Polishing.—In getting a good polish on tan leather boots, the whole of the dirt must first be removed; if a bru h will not take it off, wash the boots either with a special fluid as previously described or with cold soap water (soft water, if possible). They should then be left to dry, but not by the fire. This, of course, like the polishing, must be done on trees; a good gloss cannot be got otherwise. To polish, put a very little good brown cream upon an old soft rag folded into a small pad. Remove the superfluous polish by wiping the pad on, say, the heel of the boot or anything handy, so that the rag has only the least coat at a time. This rag is used with a circular motion, only leaving off when a little more cream has to be added. Make this circular movement in a slightly different place each time, so that the whole of the boot is covered before the starting place is again reached. Then repeat again and again, until the desired polish is attained. Boots or shoes that are only dusty should not be put away until the dust is brushed off and the boots rubbed up with a soft polishing cloth, which should be used to finish the polishing after the cream coating has set. The polishing cloth should be kept clean for this purpose, as the cream it gets in it improves it.

Brown Boots: Removing Grease Stains.—Try a thick solution of bisulphide of carbon and white guttapercha; it is the same thing as patching cement, only that it needs to be much thicker. A small bottle of cement evaporated, and the residue added to a bottle newly opened, will answer the purpose. Paint all over and just beyond the stain, and when all the spirit has passed off, rub off the guttapercha with a clean rag; if not successful, repeat a second time. The guttapercha that has been rubbed off should be saved, as it can be used again.

Brown Boots: Removing Ink Stains.—Make a little chloride of lime into a paste with water, and cover the stains with the mixture; after an hour or two, wet a rag and wash off the chloride of lime.

Brown Boots: Removing Oil Stains.—Linseed oil stains are not easy to remove, as oxidised linseed oil is insoluble in the ordinary solvents. Benzene or petroleum ether may be tried; apply to the stains several times by means of a piece of cotton-wool. If after this treatment and subsequent drying the oil stains still remain, perhaps it will be better to treat the whole of the boots with linseed oil; the leather will be darker, but it will be waterproof, and can be polished with the usual boot cream or paste.

Brown Polish.—(1) The following is a cheap paste for polishing brown boots:—20 fluid ounces of good malt vinegar, 10 fluid ounces of filtered water, 2 oz. of good glue, 1 dr. of soft soap, and 1 dr. of isinglass. Colour with annatto or turmeric to the shade required. First mix the water and vinegar, then dissolve the glue in the fluid by gently heating it; add colouring and the other ingredients, and boil from ten to fifteen minutes. Strain the mixture, and put in jars. To use this composition, lay it on with a clean sponge, and polish with a soft rag or flannel. (2) 4 lb. of best beeswax, ½ lb. of pearlash, 2 lb. of best yellow soap, 8 lb. of turpentine, ½ lb. of methylated spirit, and enough water to make the mixture of the required consistence. Put

the pearlash into the water, and set it on the fire to boil (if more water is necessary, it may be added afterwards), and scrape into it the wax and soap. Allow the mixture to boil till all is dissolved, stir well till homogeneous, and allow to cool down somewhat; then mix in the turpentine, and lastly the spirit. Well mix all by stirring. If necessary, add water. For use, rub the cream on the leather, dry polish with a soft brush, and then with a linen rag. (3) Take 6 lb. of beeswax, 2 lb. of lard, ½ lb. of neatsfoot oil, 2 lb. of turpentine, and sufficient dragon's blood to colour to fancy. Melt the wax and lard together, add the oil, and stir well; allow to cool, then mix in the turpentine. Before the mixture gets too cool, add the colouring matter and stir well in. Rub the polish on the leather, polish with a brush, and finish with a soft rag.

Creaking of Boots.—The best way to cure creaking boots is to insert powdered French chalk between the two parts that rub one against the other. Blacklead is also good, but is not so clean to use. Many shoe repairers, when they have to do this job, rip the stitches on the inside waist for about 2 in. at the end near the joint of the sole. In hand-sewn work this can be re-sewn and finished; and with riveted work the rivets can be drawn and replaced. But with machine-sewn work, unless a machine is available, this has to be riveted down, and thus it is only a cobble. In all cases a long thin screwdriver has to be worked up between the parts, and the French chalk put in, and worked about as much as necessary. But the best method is as follows:—Remove the sock from the heel and waist down as far as the joint, then with a sharp-pointed knife cut through the inner sole only for about ¾ in. to 1 in., so that the end of the cut is just at the end of the waist and the beginning of the sole. Now, if the screwdriver is put through the slit, it will not be hard to work it right up to the toe; moreover, should the boot have a middle sole, the screwdriver can be worked first between the inner sole and the middle sole, and the chalk put in, and the same repeated between the middle sole and the outer sole. To finish, tap down smooth on the iron foot, put a tingle in each side of the slit, and paste the sock down again. A few rivets up the centre of the sole will answer sometimes, but tends to make the sole stiff in wear.

Cream, Coloured.—Mix the following ingredients: 1 lb. of curd soap, 2 lb. of beeswax, 2 lb. of oil of turpentine, 4¾ pt. of water, with aniline colouring matter to the shade required. Cut up the soap and dissolve it in water by boiling, next separately dissolve the wax in the turpentine by heating the two together, and then pour them into the soap solution and briskly stir the mixture until the mass is of a creamy substance, and cool. Aniline colours should be mixed with the water before the soap is added.

Cream for Calf Kid Boots.—Ordinary blacking should not be used for calf kid boots. The best polish is white of egg; this should be kept till it is stale and forms a liquid, not a jelly. Another polish can be made by boiling pieces of calf kid, and adding a little gelatine, a very small portion of glycerine, and yellow soap; simmer up again, then strain and place in bottles.

Cream, White.—For a white cream follow the instructions given for "Cream, Coloured," above, but use white wax instead of beeswax, and no colour.

Dubbin.—(1) A good dubbin can be made by boiling together 2 lb. of black resin, 1 lb. of tallow, and 1 gal. of crude or train oil. (2) Another recipe consists of 1 gal. of boiled linseed oil, 4 lb. of mutton suet, 3 lb. of yellow beeswax, and 2 lb. of common resin; melt all the ingredients together. Warm the leather previous to well rubbing in the dubbin. The second recipe will render shoes waterproof, and can be applied to soles as well as uppers.

Finishing Boot Bottoms Brown.—To brown the bottoms of boots, put some thin brown paste on the bottoms and well sleek them just before they are quite dry; repeat till an even colour is obtained, and finish with white heelball and cloth. Or whiten the leather and burnish with a warm burnisher; this will give a darker brown. Finish as above. Another method is to rub a little of the colour on a damp sponge, apply to the boot bottoms, and finish as above. Any brown colour will give the desired effect. To gain an easier finish, instead of using white heelball, make some white or brown fake, and,

after burnishing, place a little on the boots with the finger, and when nearly dry, rub off with a cloth. A very good wash for boot bottoms can be made by mixing finely powdered pipeclay with a strong solution of oxalic acid and water, then adding a little gum. The whole should be a trifle thinner than cream. It can be coloured as required with any water stain, as burnt sienna, etc. A recipe for a finish for the soles of boots and shoes similar to Oakaline is as follows :—Take 2 oz. of refined shellac, 8 oz. of methylated alcohol, and ½ oz. of Bismarck brown in powder. Place the shellac in a bottle, then add the spirit, shaking frequently until the shellac is quite dissolved. Mix the Bismarck brown in ¾ oz. of oil of lavender, shake this up well, and add to the shellac solution. If a lighter shade of brown is required, use half the quantity of Bismarck brown. Apply the solution with a soft brush. Or take 4 oz. of yellow wax, 2 oz. of yellow soap, 5 oz. of boiled oil, and 5 oz. of turpentine. Also mix ¼ oz. of annatto in 40 oz. of water until a rich brown colour is obtained. Put the wax and soap, also the annatto water, into a pan, and boil, constantly stirring the mixture. When quite dissolved, add the oil and turps, shaking the mixture freely. Keep it in a bottle, and apply with a soft brush.

Finishing Boot Bottoms Creamy-white.—In order to get a creamy-white finish on boot bottoms, begin by making the leather quite dry ; then proceed as though making buff bottoms, only do not put on any pumice. After glasspapering, lightly brush off the dust, and resting the boot between the knees, with the buff knife scrape a little of the ball or pipeclay on the sole, so that there is only a slight sprinkling all over. Rub this in very lightly with glasspaper, not to disturb the leather, but to distribute the clay in a thin coat. Blow off all the surplus dust or clay, and then very carefully proceed as follows :—Make a small round pad of clean, new or old white flannel. Hold this between the thumb and fingers of the right hand, and hold the toe of the boot with the left, with its heel on the knees, and the sole facing the right hand. The pad must be only just damped with saliva, and from the toe the whole of the sole should be wiped over with it. Make short strokes—just a short, sweeping wipe—not finishing any of them suddenly, and re-damping the pad about every second or third time. Of course, by the time the whole is done, most parts are nearly dry, and there is not enough to form a cake anywhere. The way to put the second coat on is to hold the boot between the knees and scrape a little clay on as before, and by the time this is on the whole of the sole it should be as nearly dry as possible. Now, with a dry part of the flannel, or a hare's foot, dab all over the sole—do not rub—and let the sole get quite dry ; then brush off any surplus stuff, and a nice, clear, smooth, creamy-white bottom is the result. This will not be attained if too much buff-ball is used, or if rag and sponge are used instead of flannel, or if the sole is made too wet, and damped for the second coat of pipeclay. When buff bottoms are damped down as above, without pipeclay or buff-ball, this is called a "damped down" bottom—a quick and clean finish.

Finishing Boot Edges Black.—Well iron the edges of the boots while they are in the brown, so that they are quite bright ; then put a coat of ink on, making sure that it has struck well all over. The longer it stands to dry, the paler will the blue become. The best result is obtained by just catching it with a warm iron or burnisher as it is turning from black to blue. The iron may be hotter for the second run over the surface. When bright, give a coat of fake ; let it nearly dry, then finish off with a very soft cloth.

Finishing Boot Edges Brown.—For colouring and finishing the edges of brown boots and shoes : (1) Heat until dissolved, ½ pt, of annatto and ½ oz. of Russian glue, and apply to the edges of the boots ; this gives a rich brown stain. Then work a hot iron backwards and forwards until a good smooth edge is obtained ; this makes the edge appear as one solid piece. Some workers use glue water only ; the hot iron does the rest. (2) Get a pennyworth of burnt sienna, and mix it with water ; shake well before applying to the edges of the boots so as to get an even stain. Put it into two small bottles, say two-thirds in one bottle and the remainder in the other; fill up the

bottles with water, so giving two shades of brown. (3) Dissolve permanganate of potash in water, and use it in the same manner as ink. (4) Almost any shade desired can be obtained by mixing Dolly dyes, but these, like most stains used on the edges of leather, have to be modified according to the nature of the tanning employed in the production of the leather. For instance, by using turmeric on English leather a nice tan-looking yellow can be obtained; whilst turmeric used on foreign leather would give a greenish-yellow. Spanish annatto might also be tried. Finish with brown glazing-ball instead of white. (5) A very weak gum solution will produce a nut-brown colour on boot edges, but they must be carefully ironed while damp, the iron being only just warm.

Finishing Boot Edges Green.—A good green dye for the edges of the soles of boots can be made by mixing Dolly dye in boiling water. There is a dark and a light shade; with the two almost any shade of green can be produced. To obtain a good result, all the lifts should be the same kind of leather. First dye with the Dolly dye, and, after the first ironing, give a second coat where it has not struck satisfactorily, then iron again before applying any fake or finish.

Finishing Boot Uppers.—The following is a recipe for making a good liquid dressing for finishing boot uppers. Procure small cuttings of white leather from the saddler's, or cut up old kid gloves, parchment, etc. Cover these with water, and allow to simmer over a slow fire, stirring during the process; then add 2 tablespoonsful of sugar and 1 tablespoonful of bone-black. When all is well mixed it is ready for use. This preparation, which should be applied with a sponge, gives new goods an excellent gloss. In cold weather, place the tin containing the dressing in warm water when using it, or it will be too stiff to apply evenly.

Glace Kid Polish.—(1) A good polish for glace kid boots consists of pale gum sandarach 3 oz., and alcohol 20 fl. oz. Dissolve by frequent shakings at intervals, then add ivory black and a small quantity of glycerine (to keep the polish). (2) Procure 1 gal. of vinegar, ½ gal. of water, 1 lb. of white glue, 2 lb. of logwood chips, 1 oz. of soft soap, 1 oz. of isinglass, and 1 oz. of powdered indigo. Mix the vinegar and water, then add the glue and heat to boiling; when dissolved, add the logwood chips, and boil for half an hour, then add the soap, isinglass, and indigo, and boil for ten minutes. Strain through muslin, and, when cold, bottle up. Apply with a sponge. (3) Boil 4 oz. of logwood, ½ oz. of copperas, and 1 qt. of water, for half an hour, then strain into the following, which must be ready:—Soft soap 1 oz., glycerine 3 oz., powdered tragacanth 1 dr. Add to this compound 1 oz. of methylated spirit, containing ¼ oz. of salicylic acid and 4 minims of gaultheria oil, finally adding 1½ pt. of water. Stir well to ensure perfect amalgamation, and when cool bottle off, and cork tightly to prevent evaporation.

Guttapercha Soles, Attaching.—With a good rasp, well clean and roughen the part that is to receive the guttapercha, brush off the dust, and with a warm iron press on the bottom of the boot, till it well and closely adheres, a coating of patch adherent (guttapercha cement). Now warm before a quick fire one side of the guttapercha sole and the bottom of the boot, press them together, and allow to cool. Pare round the edges, and finish with a file and glasspaper.

Heelballs.—Heelballs can be made from carnauba wax, softened by the addition of tallow or beeswax; the exact composition can easily be found by trial. Gum arabic is not used in heelballs, because it will not melt with the wax. The black is obtained by the addition of a small quantity of drop black. Some definite recipes follow:—(1) Take ½ lb. of pure beeswax and 1 oz. of buck tallow; place these on the fire, stirring until thoroughly melted; then add ¾ oz. of gum arabic, and, for black heelball, add lamp- or bone-black until a jet black. Keep stirring, and then run it into round or square moulds, round ones being most useful. For red, use red vermilion; if too bright, add a little Bismarck brown. For blue, use ultramarine powder; for green, use Paris green. (2) Some consider the following a better recipe:—Melt together 2 lb. of best beeswax and 3 oz. of suet, and stir in 4 oz. of ivory black and 3 oz. of lampblack; then add 2 oz. of finely powdered

gum arabic (best) and 2 oz. of rock candy. These must be well mixed, and, when partly cold, poured into leaden moulds to the shape and size required. This is a black heelball. For white or bottom ball, leave out the above colours, and, if wanted only as a transparent polish, this will suffice; but if needed as a white substance, add a little flake white.

Paste (Adhesive) for White Boots.—Well mix some good white wheaten flour with water, until all lumps are removed and it is about as thick as condensed milk. Then well stir, and add boiling water till it is of the thickness of paste. It should be made in an old saucepan, so that it can be boiled till it is well set. A piece of well-powdered resin mixed in before boiling will make a better paste, but the paste will not be quite so white. For white kid, satin, silk, etc., use yellow soap. Raw white starch is also good for silk or satin.

Patching Solution.—Patching solution for boots is made of bisulphide of carbon and guttapercha. A little heat is necessary to make these amalgamate properly; and as the bisulphide is very vaporous, great care must be exercised. The ingredients should be placed in a large iron pot or pan, partly filled with boiling water, and mixed well together, but a flame must not be allowed anywhere near. Previous to the above process, the guttapercha should be allowed to stand till quite soft, and the quantity of bisulphide of carbon should be quite double that of melted guttapercha. Another usual method is to cut pure guttapercha into shreds, and place in a vessel that can afterwards be well sealed up, and yet easily opened ready for use. Cover the guttapercha with bisulphide of carbon. When dissolved, the solution, after warming, should be no thicker than single cream.

Soling and Heeling Pair of Boots.—To sole and heel a pair of riveted or machine-sewn boots, which require new soles to be riveted on, first immerse in water for a few minutes the old soles and heels of the boots, and then, if necessary, dry them a little, so as to have them just mellow. Also put the new leather in water, so as thoroughly to wet it through; then take it out, and allow to get nearly dry, but not by the fire if this can be helped. Rasp off all rough flaky stuff from the flesh side. Place the lap-iron—which is simply a laundress's iron with the handle off—between the thighs, just above the knees, put the leather on it, grain side down, and, beginning from the centre, hammer it well, evenly and gently, so as to make the leather denser and more resistive to wear, and also more impervious to dampness. While the leather dries, take off the worn top-pieces of the heel, and if the lifts are worn, cut or saw them through the centre, and take away the portion that is worn, as A (Fig. 119). Replace with new

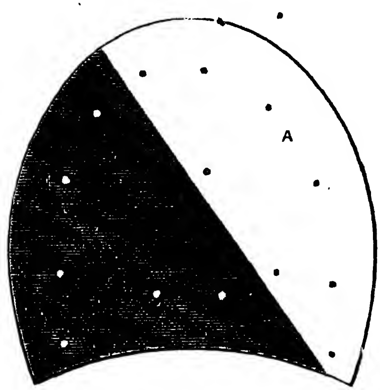


Fig. 119.—Boot Heel ready for Repairing.

leather, which need not be of the best quality. The operation of taking off the old soles requires some care. If the boots are wetted, they are far less likely to fall to pieces and otherwise give trouble than if they are worked upon in a dry state. A last can be put in the boot so as to make a solid foundation to work on; the old sole, when it is wet, can be prised off with a blunt chisel, beginning at the toe or the thinnest part; it can then be gripped with nippers, and pulled right off, using the disengaged hand to hold down the under leather (often termed welt, or runner). Should the under part still have a tendency to come away from the uppers, knock back the sole, so that it leaves the rivets sticking out; with the pincers or nippers pull out the rivets, and repeat the processes till the sole is got off without disturbing

the boot. Before putting the new sole on, the under part can be nailed down with a few short rivets to make it solid. If in the making or previous repairing very long rivets have been used, taking off the sole will need great care to avoid causing the boot to fall to pieces. A man who repairs his own boots ought never to let them wear low, and the cheaper the boots, the more particularly is this the case. For re-soling machine-sewn boots and shoes, when the lasts are in and the boots wet, skive off the edge of the sole—not right through, or the welt may be spoilt, but deep enough to cut through the stitches and cut their loops off. Then, as before, the toe can be raised or prised up from the welt, when taking off the sole is an easy

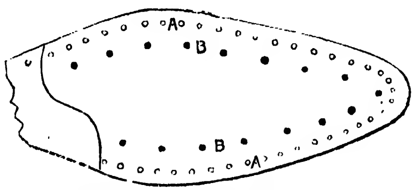


Fig. 120.—Riveted Boot Sole.

matter. If the under-sole should come away whilst taking off the outer one, the damage must be made good in the following manner:—If the last is of iron or has an iron bottom, hammer the middle or under-sole back into its place, first taking out all the old nails; then supposing A A (Fig. 120) to show the line where the rivets which fix the new sole will pass through the middle sole, put through the line B B a few short rivets or long tingles, according to the substance of the bottom. The dots B B actually show where to place the tingles, which should be only just long enough to clench on the bottom of the last. When repairing on a wooden last, and when this under-sole is being fixed, take the shoe off and slip it on the iron foot to clench the tingles, for they must be clenched before the new sole is put on. When putting the new sole on and knocking in the rivets, put extra long ones in, say, 1 in. apart, just long enough to clench through the whole thickness of the new sole, middle sole, tops, inner sole, etc. The long rivets should be of brass, so that when the shoe is again re-soled these will draw out with the thin old sole, and not

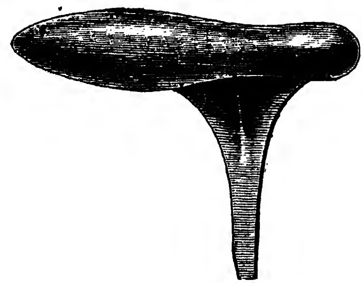


Fig. 121.—Iron Foot.

disturb the middle sole in so doing. The cause of boots falling to pieces, as they sometimes do after a short period of wear, is frequently the want of a good inner sole. If not gone too far, and if when pulling off the sole the boots are not pulled to pieces, remedy this defect by putting a new half inner sole in the forepart, and then re-sole the boots on the iron foot. If they are past this, and the uppers are good enough, re-last the forepart on a pair of iron lasts or a pair of iron-plated ones. To obtain the required lasts, the

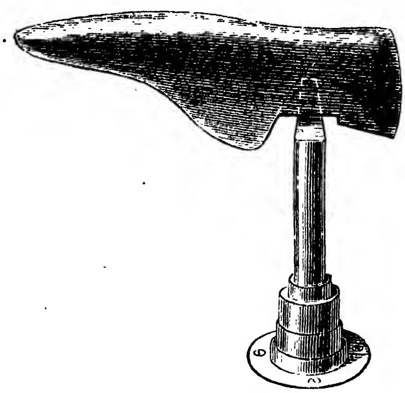


Fig. 122.—Iron Last and Stand.

size of foot must be taken in inches. Draw the tape measure just a little tighter than the boot should be, and then send off the order thus: 1 pr. gent's (boot or shoe)

lasts, joint 9 in., instep $9\frac{1}{2}$ in., as the case may be. Iron-plated ones are the cheaper, as an iron stem and stand, which cost a couple of shillings or so, are necessary with the iron last; but an iron-plated last, screwed to a bench, has the advantage that the worker can stand at it. Figs. 121 and 122 show last and stand, which can be got at any leather warehouse. Figs. 123 and 124 show a useful stand for repairing purposes which allows the foot to be fixed firmly in either of two positions. The old sole should be cut off at the waist to within about $\frac{3}{4}$ in. from where the new sole is to come. Mark off the exact length of the new sole, and then start to skive

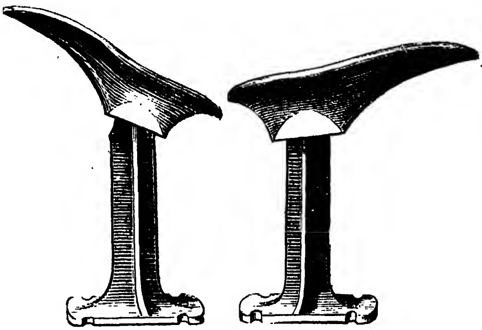


Fig. 123. Fig. 124.

Figs. 123 and 124.—Last Stand with Reversible Foot.

off from this mark, tapered to where the old sole was cut off. From the line scoop it out evenly with a knife, until about one-third of the way through as at A (Fig. 125). Then with the pene end of the hammer lightly tap down the leather, right across where hollowed out; this hardens the leather to receive the pegs or rivets and, without weakening the old leather, gives an extra drop to receive the new sole. The new sole to be spliced to this part of the waist of the boot must be skived, but not very thin; and it is best to skive on the flesh side for light work, and on the grain side for heavy work. Slightly paste the groove in the old leather, and also the new sole, where it has been skived; this tends to make the joint sound and firm when finished. It is all important properly to work the leather before using—that is, by wetting, fleshing, drying, and hammering, as already explained. In levelling up for re-soling, make the

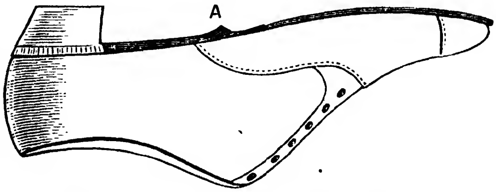


Fig. 125.—Boot with Old Sole Removed.

sole, just a little rounded, putting in just enough filling to make this difference. The bottom of a boot, if too round, is sometimes uncomfortable, and wears away quickly, whilst one hollow in the centre is uncomfortable and unsolid. A last should be somewhat round at the bottom, so that it fits the bottom or sole of the foot. The sole of the boot will be made round enough by placing a layer of felt in the middle, to prevent creaking, and to make it impervious to dampness as far as possible. This applies both to making and repairing. To fix on a new sole, place the boot or shoe on an iron foot. The sole should be put on with the skived end to overlap the groove about $\frac{1}{2}$ in., as shown at A (Fig. 126). When riveted, it should be well into the groove, as shown at A (Fig. 127). If the joint is well done, the end of the new sole will project above the old leather. This part must be pared off neatly level with the waist, then pened with the hammer and rasped off. When all these

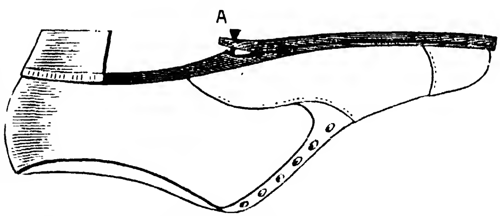


Fig. 126.—Boot with New Sole Partly Fitted.

processes are carried out, there will be a neat and permanently solid seam, as at A (Fig. 128). Before putting in the rivets, pare up the sole, not closely, but leaving

a small margin all round. About $\frac{3}{8}$ in. from the edge, draw a line all round with a pair of compasses, or with a pencil held between the thumb and finger whilst placing

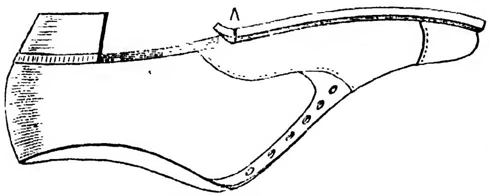


Fig. 127.—Boot with New Sole Fastened in Groove.

the second finger against the edge of the sole. Then with an awl, prick on the line, all round the sole, small holes to receive the rivets, putting them closest where most wear comes; generally, this is at the toe and outside joint, where it is best to use iron rivets; elsewhere brass rivets should be used. Fig. 129 shows about the form in which the rivets should be put in. Trim up the edge of the sole with the knife, being very careful not to cut the uppers; then damp the edge, and pene it all round with the hammer, as at A B (Fig. 130). This should be done with the shoe on the knees, the heel being towards the worker and the edge of the sole upwards. Begin at A, and go right round the sole. This process hardens the edge, tends to make it hollow, and prepares it

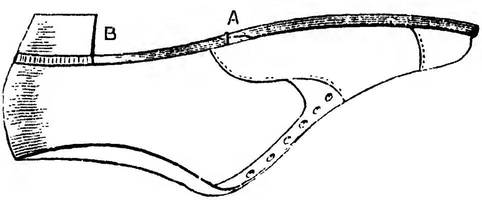


Fig. 128.—Boot with New Sole Complete.

to receive the next tool, which is the shoemaker's rasp. The toe end of a shoe is illustrated on a larger scale at Fig. 131, which shows how the pening strokes should be laid to weld the new and old leather together, and keep the edge hollow, as at A. Then let the whole boot dry while proceeding with the other one. The man who repairs his own boots should not let the heels wear more than just through the top piece, as then the heels keep in shape; but if the lifts have to be repaired, when

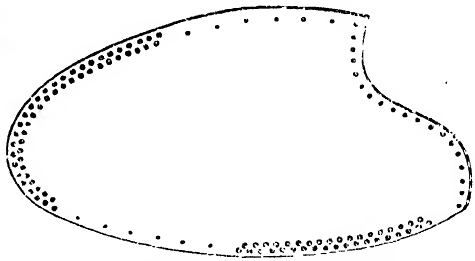


Fig. 129.—Positions of Rivets in Boot Sole.

putting on the pieces, let the nails be a little way from the edge, otherwise when the top piece is nailed on, one set of nails will come in contact with those below. When building up the heel ready for the top piece, it is well to make the side that shows the most wear a little higher, as it tends to make the wear more even. Tack the top piece on the heel (Fig. 132), putting a nail at A and one at B, and round it up with the knife, leaving a little stuff on all round, more particularly at that part which is to receive the most nails, as shown by the dotted line. The rivets should then be put in, as shown at C C, but first mark round the heel and hole it, as was done for the sole, then pare and

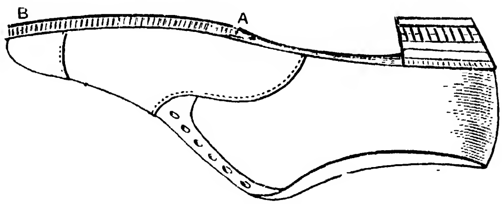


Fig. 130.—Pened Edge of Boot Sole.

pene, as described above; the edges of the soles and heels should be rasped, and then buffed with a scraper or buffing-knife. This tool, which is illustrated by Fig. 133, is similar to a cabinet-maker's scraper, and it can be made of about 3 in. of old stay-busk. Even a piece of freshly-broken glass will answer. Then smooth the edges

with a piece of No. $1\frac{1}{2}$ glasspaper. The faces of the sole and heel can be filed with the smoother side of the rasp, to make the heads of the rivets smooth and even

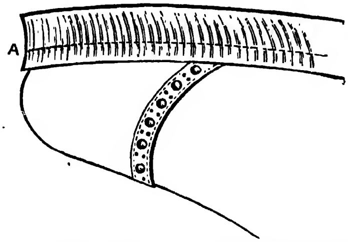


Fig. 131.—Enlarged View of Pened Edge of Boot.

with the leather; then buff off the grain of the leather with the scraper, and glasspaper the sole all over. This produces what is called a rough bottom, and all that is needed for one's own work. Rub a little paste on the edges with a piece of rag, and coat the edges and the waist with shoemaker's ink. Allow this to get just dry, and then rub over the leather with the glazing-iron (Fig. 134). This iron must not be very hot; its proper heat is such that if it is put into water it should just cause a hiss. Properly, a forepart iron should be used for the soles, but the glazer

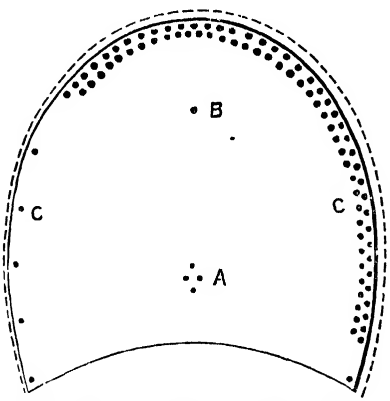


Fig. 132.—Top Piece on Boot Heel.

will do as a makeshift. This ironing process gives a nice gloss, which is increased and made more permanent by being repeated, at the same time ironing on a thin coat of heelball, which can be rubbed off smooth with a piece of old cloth, and will leave a brilliant polish. Always remember that any job in repairing can be finished much better if a last is inside the boot; and that pening, rasping, buffing and all finishing, should be begun at A (Fig. 130) for the soles, and at B (Fig. 128) for the heels. In using the knife, the action is the reverse in both cases.

Yellow Stain for Boots.—A yellow stain or dye for brown boots can be made by boiling $\frac{1}{2}$ oz. of saffron in a pint of water until it is reduced to the required strength. For a bright yellow, add $\frac{1}{4}$ pt. of best quality annatto; for a darker shade, add about as much Bismarck brown as will lie on a sixpence, and boil up again. The boots should

Fig. 133.—Shoemaker's Buffing-Knife.

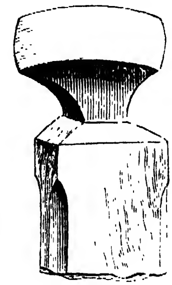


Fig. 134.—Shoemaker's Glazing-Iron.

be first well cleansed by sponging over with a solution of oxalic acid—one pennyworth in a gill of hot water. Give the boots two coats of the stain.

Waterproof Polish.—To make a waterproof paste or dressing for black leather boots:—Into a glazed vessel put 2 oz. of black resin and melt it slowly over a fire. When the resin has dissolved, add 3 oz. of beeswax, and when the latter has melted, remove the vessel from the fire, and add $\frac{1}{2}$ oz. of fine lampblack and $\frac{1}{2}$ oz. of fine Prussian blue in powder. Stir all well together, and add sufficient turpentine to form a thin paste. When cool, the paste is applied to the leather with a sponge, and polished with a soft brush. Another recipe for a waterproof polish is:—Melt 2 oz. of beeswax, 4 oz. of mutton suet, 12 oz. of

sugar candy (dissolve the candy in hot water until of the consistency of syrup and then add), 4 oz. of soft soap, 2 oz. of ivory black, and 2 oz. of indigo. When melted and well mixed, add ½ pt. of turpentine and 1 oz. of glycerine. This can be kept in collapsible tubes.

White Paste (Dressing) for Canvas Shoes.—Scrape some pipeclay into a saucer, add a few pieces of oxalic acid and a very small portion of washing blue, and then pour on warm water till the paste is of the required thickness. If a paste not of quite such a dead white is desired, scrape in a little buff-ball after the acid has dissolved. The paste is well rubbed into the shoes, and, when dry, rubbed out first and then lightly brushed.

Borax

The manufacture of borax, a substance largely used in the arts and for household purposes, consists of a simple process of separation, borax, more or less pure, being found in many parts of the world. The material is first ground in boiling water containing a small portion of calcined carbonate of soda, and the clear solution obtained is run into tanks and crystallised. The product contains 50 per cent. borax, the rest being sulphate of lime and common salt. The crystals are heated to a certain temperature at a given concentration, when the borax proper crystallises out and separates from the impurities held in suspension, the mother liquid being drawn off. Borax has been found in such quantities of late years that it has declined greatly in price; at one time it cost more than £40 per ton, but in 1900 the retail price was only 3d. per lb. The uses of borax are numerous. When melted at a high temperature it dissolves metallic oxides and forms transparent coloured glasses. It is used as a flux in welding metals and in melting gold and silver. It is employed in the manufacture of granite ironware, of enamelled bath tubs, and other articles, as well as in making pottery and earthenware. Manufacturers of the hard, tough grades of glass and of encaustic tiles are large users of borax. It is used by painters, tanners, hatmakers, and calico makers, as well as by beef packers. The domestic uses of borax are widely known, and in chemistry and metallurgy the borates are employed in many ways.

Borax for Brazing.—For brazing purposes it is usual to employ borax and water as a flux. Water will only dissolve a very small quantity of borax properly. It is, therefore, not possible to mix borax powder and water in anything but a paste in which the borax sinks. This sinking of the borax does no harm, as, when hot, it melts and spreads all over the work evenly. For small articles requiring only a very little borax, such as spectacle frames, keys, etc., lump borax rubbed down with water on a slate produces a paste of much finer and more even consistency than does borax powder.

Detecting Borax in Food.—The detection of boric acid and borax in foods is often of importance, since the boric acid (also called boracic acid) and its compound with sodium (borax) are often used to preserve animal products, such as sausage, butter, and sometimes milk. For the detection of boric acid and borax, solids should be macerated with a small amount of water and strained through a white cotton cloth. The liquid obtained in this manner is clarified somewhat by thoroughly chilling and filtering through filter paper. In testing butter, place a heaped teaspoonful of the sample in a teacup, add a couple of teaspoonsful of hot water, and stand the cup in a vessel containing a little hot water until the butter is thoroughly melted. Mix the contents of the cup well by stirring with a teaspoon, and set the cup with the spoon in it in a cold place until the butter is solid. The spoon with the butter (which adheres to it) is now removed from the cup and the remaining turbid liquid is then strained through a white cotton cloth, or better, through filter paper. The liquid will not all pass through the cloth or filter paper, but a sufficient amount for the test may be secured readily. In testing milk for boric acid, two or three tablespoonsful of milk are placed in a bottle with twice that amount of a solution of a teaspoonful of alum in a pint of water, shaken vigorously, and filtered through filter paper. Here again a clear or only slightly turbid liquid passes through the paper. About a teaspoonful of the liquid obtained by any one of the methods mentioned above is

placed in any dish, not metal, and five drops of hydrochloric (muriatic) acid added. A strip of turmeric paper is now dipped into the liquid and then held in a warm place—near a stove or lamp—till dry. If boric acid or borax were present in the sample the turmeric paper becomes bright cherry red when dry. A drop of household ammonia changes the red colour to dark green or greenish black. If too much hydrochloric acid is used the turmeric paper may take on a brownish-red colour even in the absence of boric acid. In this case, however, ammonia changes the colour to brown, just as it does turmeric paper which has not been dipped into the acid solution.

Removing Melted Borax after Brazing.—Borax can be removed by immersing the brazed article in very dilute sulphuric acid and swilling afterwards in clean water so as to remove all acid.

Sprinkling Borax.—This is used in the place of ordinary borax, when considerable soldering is done. It is not only cheaper, but also dissolves less in soldering than pure borax. The borax is heated in a metal vessel until it has lost its water of crystallisation, and then is mixed with calcined cooking salt and potash—borax 8 parts, cooking salt 3 parts, and potash 3 parts. Next, it is pounded in a mortar into a fine powder, ready for use. Another kind of sprinkling borax is prepared by substituting glass-gall for the potash. Glass-gall is the froth floating on the melted glass, which can be skimmed off. For use, borax is either dusted on as a powder from a sprinkling box, or it is stirred with water into a thin paste.

Fig. 135.—End of Shell Bit.

Fig. 136.—End of Spoon Bit.

Fig. 137 —End of Nose Bit

Fig. 138.—End of Half-twist Bit.

Fig. 139.—Hollow Taper Bit.

Boring Bits for Wood

Boring bits for wood are of many different kinds. Of the shell-type and twist-type bits are :—The pin bit, resembling a gouge sharpened inside and outside ; with its corners removed it becomes a shell bit (Fig. 135), and the contact with the wood then taking place in the centre of the end of the bit, the cutting is improved. The shell bit is only suitable for boring at right angles to the fibre of the wood, the sharp gouge-like edge cutting freely ; it is an excellent bit for boring right through. The sharp edge of the shell bit ground to a point forms a dowel bit, which, except for its wider stem, is practically the same shape as the spoon bit. The spoon bit (Fig. 136) somewhat resembles a tea-spoon in shape, and is also something of the outline of the Gothic arch, the metal being hollowed out to form a cutting edge. This bit is strong and cheap, bores easily, freely,

and well. A nose bit, shown by Fig. 137, resembles the spoon bit, but its cutting edge is a part of the steel bent nearly to a right-angle, and sharpened to form a sort of chisel, with rounded corners; this bit is not to be depended on for boring across the grain, but for boring the end-way of the grain it is cheap and efficient. The half-twist or Norwegian bit (Fig. 138), also known as the twist-nose bit, works well in all woods and any way of the grain; but it would not do for boring holes in narrow strips of wood. Fig. 139 shows a hollow taper bit used for enlarging holes. Patent screw bits bore well in any wood, and in any direction, cutting true to dimensions. Fig. 140 shows Gedge's, Fig. 141 Scotch pattern, Fig. 142 Jennings', Fig. 143 single twist, and Fig. 144 solid nose screw bits. Jennings' and Gedge's are particularly good. The most commonly used bits are centre bits, the ordinary form of which is shown by Fig. 145. A centre bit with screw instead of pin is shown by Fig. 146. They are used successfully for boring large holes, and owing to the fact that they bore exactly where the hole is required are much superior to shell-type bits. Small centre bits are useful for making keyholes in fitting locks. The three parts of a centre bit are (1) a pin or centre, (2) a circle-cutter (the "nicker"), and (3) a chisel (the "router"), to remove the core of the hole. When buying centre bits, remember that the hole by no means agrees with the size of the bit; for example, a $\frac{1}{2}$-in. bit bores a hole at least $\frac{9}{16}$ in. in diameter, the reason of this being that the pin is not quite in the centre, and the circle cut is thus of larger diameter than the width of the tool. To gauge a bit, the most exact method is to bore a hole in a piece of waste wood and measure the diameter of it. Large centre bits may have two or even three nickers on one side and are expensive.

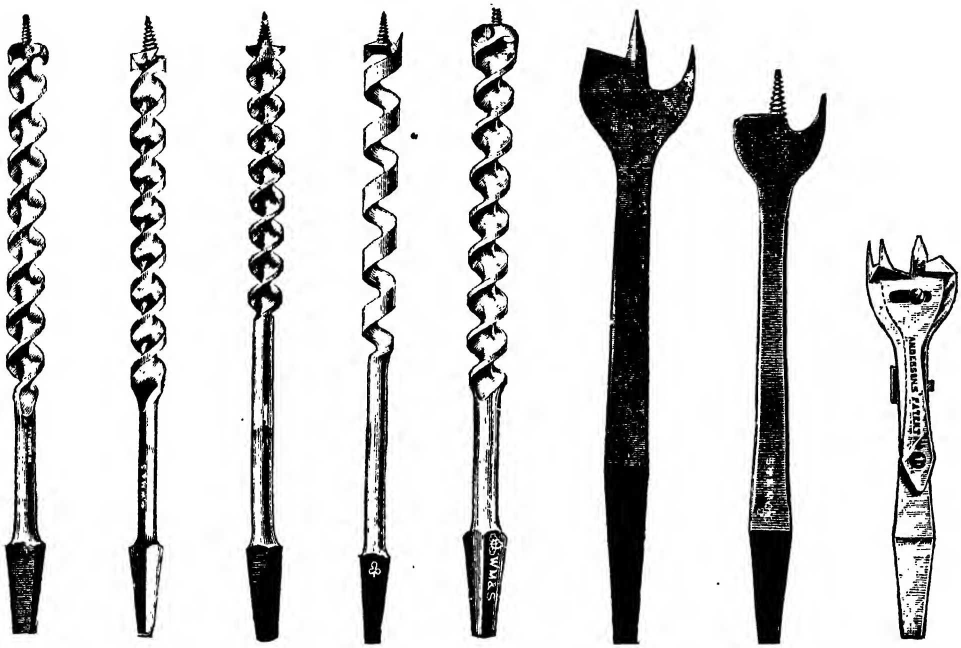


Fig. 140. Fig. 141. Fig. 142. Fig. 143. Fig. 144. Fig. 145. Fig. 146. Fig. 147.

Fig. 140.—Gedge's Screw Bit. Fig. 141.—Scotch Screw Bit. Fig. 142.—Jennings' Screw Bit. Fig. 143.—Single-twist Screw Auger Bit with Nicker. Fig. 144.—Solid Nose Screw Bit. Fig. 145.—Pin Centre Bit. Fig. 146.—Screw Centre Bit. Fig. 147.—Expanding Centre Bit.

Patent expanding bits (Fig. 147) are also in use. Boring bits are used in a brace (Figs. 148 and 149).

Bottles

(*see also* "Glass Bottles")

Cementing Brass Tops to Bottles.—A cement that, though not always satisfactory, is often used is made by mixing plaster-of-Paris with water. A far better cement is obtained by dissolving 1 part of caustic soda in 5 parts of water, then heating the solution and stirring in 3 parts of powdered resin. This solution is mixed with sufficient plaster-of-Paris to form a paste and applied immediately. Marine glue also is very good; the brass cap may be heated slightly, touched inside with the melted marine glue, then placed on the bottle neck; the latter should also be warmed before the cap is put on. The warming of the bottle neck will have to be carefully done, or it will crack.

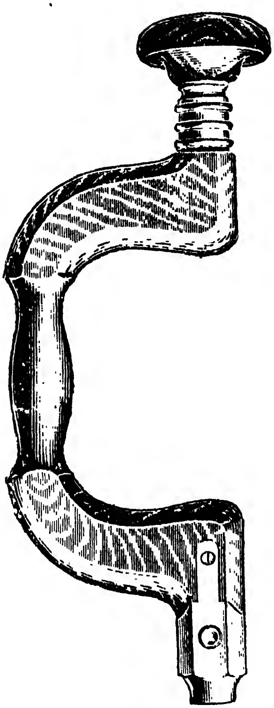


Fig. 148.—Wooden Brace.

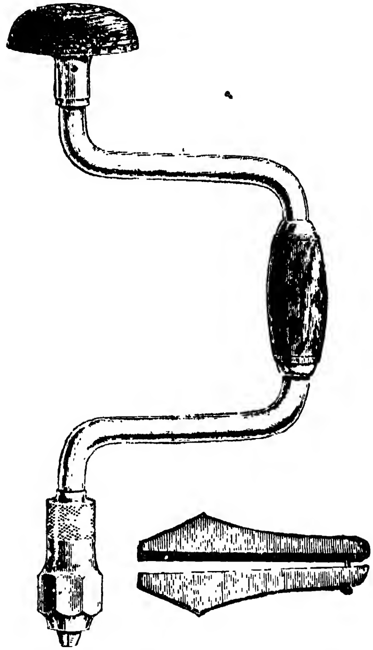


Fig. 149.—Steel Brace and Jaw Chuck.

Chemists' Show Bottles.—In filling show bottles, first put in sufficient distilled water and add the concentrated colouring solution, made as below, so as to give a tint which, with a light behind it, shows up better than a decided colour. The greater proportionately the diameter of the bottle, the less colour will be required. For a blue liquid, dissolve 1 oz. of blue vitriol in ½ pt. of water, and add sufficient ammonia water to dissolve the precipitate first formed. A green liquid may be made by adding bichromate of potassium to the above blue one; if turbid, add ammonia water. For purple, dissolve 1 gr. of salicylic acid in 2 fluid drachms of alcohol and 2 oz. of water; add 30 drops of tincture of chloride of iron dissolved in 2 oz. of water. For red, dissolve ½ dr. of iodine by means of ½ dr. of potassium iodide in ½ pt. of water, and add 1 oz. of muriatic acid. An orange tint is obtained by dissolving bichromate of potash in water. For yellow, dissolve 3 parts of bichromate of potash and 2 parts of carbonate of potassium in water. To prevent the bursting of

chemists' show bottles, alcohol or glycerine should replace a part of the distilled water used for thinning down the concentrated colouring solutions; the addition lowers the freezing point of the liquid. Multicolour show-globe liquids are made as follow:—A succession of charges of liquids possessing different weights for equal volumes are poured, one upon the other, into the clear glass globe that is to be illuminated by a light from behind. Each liquid is tinted differently, and each will retain its position, unmixed with the rest, if the order given below is adhered to. Any of the seven colours named below can be selected, but those first in the list must be placed first inside the globe. Sulphuric acid, chemically pure, tinted blue with indigo sulphate; chloroform, chemically pure, untinted; glycerine tinted brown with caramel; castor oil tinted with alkanet root; 40 per cent. alcohol tinted green with aniline; cod liver oil containing 1 per cent. oil of turpentine; 94 per cent. alcohol tinted with violet aniline. When pouring in successive charges, a funnel with a small lower aperture should be used, and a piece of cork floating on the surface should receive the stream.

Cleaning Bottles.—As a rule, hot water is used, but in special cases washing soda, or even caustic soda, may have to be employed. In washing by hand it is useful to have a bottle brush, or a handful of shot, which are shaken along with the water. In large establishments, bottle-washing machines are used, consisting of a tank, with a framework holding bottle brushes of the ordinary pattern, but stronger, the brushes being on both sides of the partition. These brushes are revolved at a high rate of speed. The tank is filled with moderately hot water, and the bottles put in to steep. The washers then remove the bottles one by one, empty out part of the water, and press the necks against the revolving brushes. The bottles are then properly emptied, and placed on racks to drain. This machine is worked from both sides, and one man will manipulate two bottles at a time. Bottles that have contained oil, turpentine, ketchup, etc., may be cleaned by rinsing out first with clean water; then about half fill them with warm soap and water, pour in about 2 oz. of large shot (pellets), and shake vigorously; pour the shot from one bottle to another. Finally, wash again with clean water. Oily bottles can also be successfully treated as follows:—Wash the bottles in warm soapsuds in which some washing soda has been placed. Should the oil still cling to the bottles, shake into them, along with the soap and water, a little fine shot. After washing in clean water, rinse the bottles with a little methylated spirit, pouring it from one bottle to another; then put them on a sloping rack to drain, mouth downwards.

Cutting and Drilling Bottles (*see* Glass Bottles).

Deodorising Bottles.—To deodorise bottles in which strongly smelling alcoholic liquors have been kept, pour into them powdered black mustard seed and lukewarm water, shake, pour out, and rinse with clean water.

Models Built Inside Bottles.—There are at least three ways by which a model can be built inside a bottle:—(1) The model for enclosure is built first, and so fitted together that it can be taken apart and again easily rebuilt, a system of simple holes and pegs fitting them forming all joints. The model is then introduced, piece by piece, into the bottle, and fitted together inside—a couple of pairs of long pliers or even curling tongs being used to hold and place the several pieces. (2) The model is built solid, and placed in a bottle partly made. The neck is then contracted or the bottom closed up, and finished to look like an ordinary bottle. (3) A bottle of suitable size is selected, and a piece of wood introduced into the neck, fitting quite loosely and sticking out a few inches when touching the bottom. A smart blow from a hammer will knock out the bottom quite clean. The model is then introduced, and the bottom cemented in again with a transparent glass cement. The third way is the commonest; the second is the best.

Bowden Brake (*see* Cycle)

Bowls (Playing)

Polishing Bowls.—If the bowls have already been in use, the old varnish, etc., should be removed to enable the stain to strike into and permanently dye the wood

fibres. This can be done by frequent washings in hot water in which plenty of common soda has been dissolved. A good black stain may be made as follows :—Boil till well dissolved, in an iron pot, ½ gal. of strong vinegar, 1 lb. of extract of logwood, ¼ lb. of green copperas, 2 oz. of China blue, and 1 oz. of nut galls. Then add ½ pt. of vinegar that has stood for a day or more in a jar containing plenty of rusty iron, nails, or turnings. The stain should be applied hot if possible ; two or three applications may be given. French polish gives a good finished appearance, but does not wear well ; oil varnish, though giving a more glaring finish, wears better. If this is objected to, a waterproof polish made as follows might be tried :—4 oz. of gum benzoin, 1 oz. of gum sandarach, 1 oz. of gum anime, and 1 pt. of methylated spirit. When these are dissolved and strained, add ¼ gill of poppy oil. An intense black may be imparted to the polish by adding ¼ oz. of black aniline dye, spirit soluble.

Fig. 150.—Bradawl.

Fig. 151.—Brass-capped Bradawl.

Boxes (*see* Cardboard Boxes)

Bradawls

Bradawls are well-known and useful tools for making small holes in soft wood. They have cylindrical stems with a sharp chisel edge. In sharpening bradawls, never convert this edge into a point, as then the bradawl cannot do its work. The ordinary form of bradawl is shown by Fig. 150. The patent brass-capped bradawl shown by Fig. 151 is an improvement on the ordinary form, this brass-cap securing the blade so firmly in the handle that they cannot come apart, as is sometimes the case with ordinary bradawls when withdrawing from hard wood. To prevent the tang leaving the handle, one method is to soften the tang at the extreme end by making it red-hot in a gas flame. If allowed to cool gradually it will be found to be softer and tougher than before. Mark the length of the tang on the bradawl handle, and at ⅛ in. from this mark, towards the end where the shoulder of the awl comes, bore a hole at right angles, or nearly so, with the tang hole. Slightly bend the tip of the tang, and insert it in its handle. By driving a brad into the hole previously bored (see Fig. 152), the slight bending of the tang can be increased to form a hook, while the brad makes the bent end embed itself tightly into the handle. File off the brad at both ends, and with one or two riveting blows the blade is firmly fixed in the handle.

Brass

Brass is an alloy of copper and zinc, the proportions varying from 66 per cent. copper and 34 per cent. zinc for fine yellow brass, to 70 per cent. copper and 30 per cent. zinc. Lead is often added, and tin. Thus, for hard common brass, use 79½ per cent. copper, 6½ per cent. zinc, and 14 per cent. tin.

Bending Brass Curtain Poles (*see* Tubes).

Bending Brass Tube.—For bending brazed soft-drawn brass tubes of small diameter load the tubes with lead and bend them, after well annealing, round a wheel or block the diameter of which is equal to

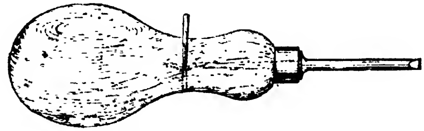


Fig. 152.—Fixing Bradawl Blade.

the inner diameter of the bend required. If the tube is sufficiently soft at first, there will be but the very slightest kink and no crack outside. Tubes that are required in quantities are bent without loading by

means of a machine consisting of three small steel rollers grooved to the size of the tube to be bent. The rollers vary from $\frac{3}{4}$ in. in diameter to almost any size, and work in a triangular form. On passing the tube through the rollers, it is curved to the diameter of the rolls without in any way damaging it.

Blackening Brass.—(1) To blacken brass, make up the following solution:—Water 3 gal., verdigris 2 lb., carbonate of soda 2 lb., carbonate of ammonia 2 lb. A stone vessel should be used for holding the solution, which should be made as hot as a hot-water bath can make it. Pound up the verdigris into a powder, and add to the water in the vessel; allow this to soak for some time. Next add $1\frac{1}{2}$ lb. of the soda carbonate, and stir thoroughly; then add 1 lb. of the carbonate of ammonia. Stir, and add the carbonate of ammonia little by little till the desired result is obtained. It usually takes the full quantities named, but by mixing gradually in this way allowance can readily be made for varying strengths of chemicals. A clear solution will be the result. The brass must be well cleansed from all grease. Greasy or oily work may be given a benzine bath, afterwards putting in the potash solution, and finally rinsing. Next give a light acid dip. When rinsed, the articles may be placed in the blackening solution. The length of time it will be necessary for the articles to remain in this bath depends on the colour required; usually from 30 sec. to 2 min. will be ample. The usual effects will be first dark red, turning to a purple iridescence, which rapidly turns to black. All qualities of brass may be blackened, the black lasting a long time. It will be necessary to give the articles a coat of transparent enamel, and care must be taken to keep the bath free from any foreign matters. (2) Another method: Dip the brass in a bath consisting of 1 part of sulphate of iron and 1 part of white arsenic dissolved in 12 parts of hydrochloric acid. When the article has become sufficiently black, rinse it well in several changes of cold water to remove the acid, dry in sawdust, and polish with blacklead; it may then be lacquered with a pale lacquer. (3) Another method, and one more generally adopted, although somewhat more expensive, is as follows:—Well polish the article with tripoli, and afterwards wash it well in a mixture consisting of 1 part of nitrate of tin and 2 parts of chloride of gold dissolved in a little water and acid. Remove the article and wipe it with a clean linen rag. A slight excess of acid will increase the intensity of the black. (4) The following method will also be found very good, and is the same as that adopted in oxidising silver articles. Give the article a light silver-plating by deposition, in a similar manner to ordinary cheap electro-plated goods. Then prepare a solution made as follows:—Dissolve in a little acetic acid 2 dwt. of sulphate of copper, 1 dwt. of nitrate of potash, and 2 dwt. of muriate of ammonia. After warming the articles, apply the solution with a camel-hair pencil, or immerse in the bath, then expose them to the fumes of sulphur in a closed box. This may readily be done by placing in a tin biscuit-box a red-hot iron bowl, such as the bowl off a small lead ladle, in which are a few pieces of sulphur. Hang the articles on a rod across the tin, and close the lid. It will be necessary to do this where there is a fairly good draught to carry off the sulphur fumes. (5) Hiorns in his book on "Metal Colouring and Bronzing" gives the following as a simple and effective method of obtaining a lustrous black on brasswork:—Dissolve 10 oz. of copper nitrate in 20 oz. of water, then slowly add ammonia until the precipitate which first forms is just redissolved. The metal is dipped in this solution, then rinsed and dried in sawdust; if the metal is subsequently heated, it assumes a steely-black colour. (6) This is suitable for brass buttons, etc. Immerse in a strong solution of copper nitrate or sulphate. Then heat on a hot plate, or carefully in the flame of a Bunsen burner, till black. Well swill in hot water, and dry out in sawdust; polish with a blacklead brush, and then lacquer. (7) The following is a good method of blackening the brass fittings of photographic or other apparatus:—Mix 1 oz. of saturated solution of silver in nitric acid with 4 oz. of saturated solution of copper in nitric acid. In both cases use jars much larger than the bulk of the acids, or they will boil

over and run to waste. When both lots of acid are quite "killed" with the metals, mix and stove. To use, dip the articles in the mixture, and make them quite hot over a spirit lamp or gas flame; then rub them with a cloth. The black coating will not rub off, and will remain thick a very long time unless corroded.

Burnishing Brass.—The finish that is usually seen on electroliers, gas fittings, bedstead fittings, and the like, is obtained by burnishing. The burnishers are of various shapes, and are made of different materials, the most usual substances being hardened cast-steel, agate, flint, and bloodstone (steel and bloodstones being the commonest). In bloodstones the grain should be close, hard, and without seams or veins, and the colour should be of an intense dark red; the steel must be fine and close-grained and perfectly polished. The face of the burnishers is soon lost, and must be restored by rubbing on a piece of leather (which is stretched over a wooden block) covered with tin-putty, Venetian tripoli, or rottenstone, with a little oil. The tools are of several shapes, and vary according to the class of work; the commonest shapes are lance, tooth, knife, half sphere, or dog's tongue. Burnishing usually consists of two operations, which are roughing and finishing; the tools for the first operation have a sharp edge, and for the second operation a rounded edge. The tools and the work must be very frequently wetted, in order that the tool may glide over the surface. The solutions that are used are pure water, soap water, cream of tartar, and vinegar. The articles are first brightened by dipping in nitric acid, and, after swilling well, are burnished with water (usually) or with water and cream of tartar. After burnishing, the surface is wiped down with a clean rag, and when dry is lacquered with a clear colourless lacquer.

Cementing Brass to Glass (*see* Glass).

Cleaning Annealed Brass.—Large sheets of brass should be annealed in a properly constructed muffle or furnace; small pieces may be done in an open fire of cinders or small coke, not too hot. Heat the plates to a dull red heat in the dark, and leave to cool off. They require careful watching, or they will burn. The scale can only be got rid of by grinding on a large stone, or otherwise by the use of pumice-stone and water, followed by dressing off with Tam-o'-Shanter stone. For cleaning up after firing, try a solution of about 1 part of nitric acid in 6 parts of water, slightly heating the brass before plunging it in, leaving for a minute or two, then brushing with a stiff worn-out brush and finally washing in clean water and drying in hot sawdust. The solution may be bottled and used over again, adding a little fresh acid from time to time.

Cleaning and Restoring Bedstead Brass-work.—Bedstead brasswork turns black in places with wear, owing to the lacquer having worn off. To clean, take the bedstead to pieces, and boil the brasswork in a strong solution of common washing soda until all the lacquer is removed. The rods must be stood in the vessel containing the soda water and some of the solution poured over them. They must next be swilled in clean water to remove every trace of soda, and thoroughly dried. They are then polished with list, oil, and rottenstone. The method of procedure is as follows:—Take a rod and secure it in a horizontal position about 3 ft. 6 in. from the floor. Make a paste of rottenstone and oil, and spread a little on a strip of list about 1 yd. in length. Wrap the list one complete turn and a half round the tube, take hold of the ends, one in each hand, and pull with the right and left hand alternately, keeping the list taut, and gradually pass it along the tube until all imperfections are removed. If some of the black refuses to come off, it must be removed with a fine float, and the list again used. When quite clean, wipe the rod until no grease remains, and dust it with finely powdered rottenstone. Finally, polish the rod with a fresh piece of list. The same piece of list can be used repeatedly if kept to its special operation. To renovate the knobs, etc., fix them in the lathe and clean with finest emery cloth—that used by gun-makers, etc., costing about 4d. per sheet, is best—and finish with a burnisher, using thick soapsuds as a lubricant. The parts must then be swilled in clean water and dried in sawdust. Ornaments must be done either with emery cloth, which will give a matt surface, or with hand scrapers and burnishers, then washed, and dried in sawdust. Lacquer-

ing is performed as follows :—Procure from a drysalter ½ pt. of best gold amber lacquer and a camel-hair brush of not less than ½ in. diameter. The amateur's only method of heating the rods is by steam ; this can be accomplished very easily by using the kitchen kettle. If the nozzle is too large, a false one can be made of sheet tin. Get a round stick, slip it into one end of the rod, and put the other end on the kettle spout. When the rod is too hot to bear the front of the hand upon it, the lacquer must be carefully applied. The brush must not be too full or the lacquer will run in streaks ; use the brush by working it backward and forward from end to end of the tube ; the colour is gradually deepened by continual brushing until the desired shade is obtained. If in the first attempt the rod is spoiled, the lacquer must be washed off in soda water. The knobs, etc., can be heated on an iron plate placed over the fire, but care must be exercised or they will burn. The bedstead can be put together again by the use of pliers with washleather between the jaws. "Zapon" is a cold lacquer, sold by the Frederick Crane Chemical Co., which is well suited to the amateur's requirements in such a job as the above.

Cleaning Brass Buttons.—Polish the buttons thoroughly with Globe polish or similar metal polish, and finish off with a little whiting. When quite bright, coat them thinly with a little "Zapon," mentioned in the previous paragraph. This will act as a lacquer and preserve the brightness of the polish for a considerable time. If the buttons are silver-plated, thoroughly clean them with plate powder and cover as before with enamel.

Cleaning Brass Gas-pipes.—If the gas-pipes have been lacquered, it will be necessary to boil off the lacquer in a strong solution of soda. They should then be dipped in dipping acid or sulphuric acid, well washed in water, dried off in sawdust, then polished in the usual way on a leather buff, and finished with crocus on a calico or felt dolly. If the pipes are fixed and are not lacquered, they may be rubbed with flour emery and oil, and finished off with crocus powder.

Cleaning Brass Pan.—To remove from a brass preserving pan a stain caused by spilling sal ammoniac, use a metal polish such as Globe polish, or use Monkey Brand soap. If the stain is deep-seated, apply oxalic acid and water with a rag until the stain is removed, then wash off and polish with whiting and water. Care should be taken in handling the oxalic acid, as it is of a poisonous nature.

Cleaning Brass Plaque.—If the plaque has become thoroughly caked with decomposed metal it may be necessary first to soak it in acid ; if so, nitric acid, sufficiently diluted to bite quite gently, will be best. Otherwise, merely scrubbing with Monkey Brand soap will suffice. The brass, however, soon tarnishes again after this, which makes lacquering desirable. Soaking in dilute liquid ammonia and then scrubbing with a soft brush will also effectually clean the plaque.

Cleaning Brass Water Taps.—If the taps are not in too bad a state, try Globe metal polish. When they are very much tarnished, proceed as described on p. 93 for "Cleaning Lacquered Brasswork."

Cleaning Chased Brass.—To clean chased brass, wash it well with hot water and soap and dry thoroughly. Then rub it all over with a cut lemon, and when it looks quite clean, rinse well in warm water, and dry and polish with a chamois leather. Chased work of any kind should not be cleaned with powder.

Cleaning Indian Brasswork.—Indian figured brass showing conventionally designed animals, foliage, and flowers, partly cast and partly executed with sharp punches, may have red or black enamel between the figures. If this appears to be an oil colour and is improved in appearance by the application of oil, the brass is best cleaned by an oily metal-polishing paste, which is prepared by mixing some finest grade best American tripoli with sweet oil to a thin creamy paste. Stir this frequently, allow it to settle down, pour off the surplus oil, and use the remaining paste. Apply freely with an old clean linen rag, and rub the tarnished spots briskly ; then wipe off all surplus paste with the same rag, and polish with a clean one. Deeply punched designs may afterwards be beaten with a soft brush. Globe polish is an excellent polish for this class of brasswork.

Cleaning Lacquered Brass.—Boil off the old lacquer by immersion in a hot solution of carbonate of soda—1 lb. to 1 gal. of water —dry out in sawdust, then relacquer on a hot plate or in an oven. For a full description *see* "Cleaning and Restoring Bedstead Brasswork" on p. 91.

Dipping Brass Castings.—The following is the process of dipping small brass castings so that they will have an even colour. The articles must first be cleaned free from grease and dirt, then strung together on a copper wire and suspended in a bath composed of spent acid, which will be much improved by the addition of a small quantity of copper in solution. Allow the articles to stay in the bath for one or two hours, then swill, and dip them, still on the copper wire, in a bath of nitric acid of 36° Baumé mixed with a small quantity of sulphuric acid. This bath is best used warm, though it can be used cold with good effect. Allow the articles to remain in the bath till dense red fumes appear, then take them out and well swill in clean water. If this does not give the desired effect, re-dip in the nitric acid bath. The straw-coloured acid is the best for dipping. A solution of nitric acid, in the proportion of 1 part acid to 7 or 8 of water, is often used as a preliminary, followed by a stronger solution. Another bath consists of hydrochloric acid and alum. A dead appearance may be obtained by using nitric acid 6 parts, sulphuric acid 2 parts, water 2 parts, and zinc sulphate 1 part.

Etching Brass (*see* main heading, Etching).

Frosting Brass.—Sheet brass that is to be frosted is either lacquered, put in an acid pickle, or its surface abraded in a particular manner. Or the sheets may be swabbed with dilute sulphuric acid to which some dissolved bichromate of potash has been added, though for this a large trough and a plentiful supply of water for rinsing will be required. Perhaps the following will best suit the circumstances:—Procure a large, round, firm piece of cork and some pumice-stone powder. Get the brass free from definite scratches, and strew thickly over its surface the pumice powder; then work the cork round and round, using a very small quantity of water. The circular motion of the cork pad ought not to leave direction marks. Continue until there is a good even matt or granulated ground. Swill off the worn pumice powder immediately it has lost its fret, and feed with fresh. Use the bob to polish the sheets before frosting. The polish would give a fine foundation for working on. Lacquer afterwards. If the plates are very large, try silver sand with the cork pad in place of the pumice powder.

Melting Small Quantities of Brass.—The only way in which small quantities of brass may be melted by gas would be by using a Fletcher's injector furnace. The gas is mixed very intimately with air by means of a small foot-blower, and is conveyed to the inside of the furnace, where, on ignition, sufficient heat is generated to melt brass in ten or twelve minutes, starting cold. Or, with a good kitchen grate, the following expedient might possibly be adopted:—A hollow casting, about $\frac{3}{8}$ in. to $\frac{1}{2}$ in. thick, similar to Fig. 153, must be procured, the measurements being taken according to the measurements of the grate. If only 2 lb. or so of metal is to be melted at a time, the casting might be used as made, but it would be preferable to line the inside with $\frac{1}{2}$-in. or 1-in. firebrick slips to protect the iron. The casting should be put in the well of the grate, and the opening to the chimney above the casting should be stopped with a plate of sheet iron to prevent air passing up other than through the furnace. For fuel use gas coke, and when the fire is started, cover the top of the casting with a plate of iron or a firebrick slab, when the air drawn

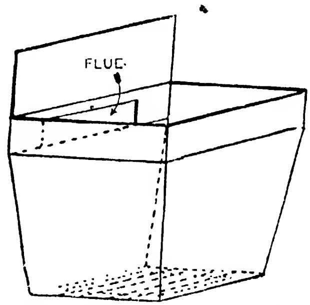


Fig. 153.—Hollow Casting for Melting Small Quantity of Brass.

up by means of the chimney draught will pass through the furnace and create a heat suitable for melting brass. A crucible allowing 2 in. spacing all round may be used, so that a very fair quantity of metal may be melted at a time. Of course, a wooden pattern from which to cast the iron will have to be made; this pattern must have a slight taper from top to bottom, so that it can be withdrawn from the sand in moulding. Allow an inch flange on the bottom to carry three or four wrought-iron bars an inch square as firebars.

Oxidising Brass (*see* main heading, Oxidising).

Polishing Brass.—To obtain a high polish on brasswork a polishing lathe is necessary. This will have to be run by power, as it would be next to impossible to gear the machine up to work by foot at sufficient speed. Grease compo and polishing mops, also sand and lime, will be required. A brown linen mop for use with the grease compo or tripoli will be wanted, and a white linen one for finishing with rouge. If the work to be polished is fairly smooth, the sanding may be omitted and the lime used first. After a bright face is obtained the articles must be further polished with the tripoli compo, and finally with rouge if a very high degree of finish is required. For ordinary brasswork, the finish may be obtained after lining by using tripoli compo, or compo only. Brass, copper, or kindred metals to be made into trays, etc., should, before being worked, be hammered flat, ground, and glazed on a glazing wheel. The material is then ready to be worked by engraving, repoussé work, saw piercing, or a combination of these processes. The articles must next be thoroughly washed in a bath of hot soda water, brushed so that all the oil and dirt are removed, and should then be washed in cold spring water; after this they may be dipped in a bath of dilute sulphuric acid, and washed at once thoroughly in cold water. The article is now ready for polishing, which is accomplished by buffs of several sizes, and dollies which revolve at great speed. The buffs are wooden wheels of various sizes, round which buff leather is fixed. These are coated with glue and rolled in emery powder of different grades, thus giving to the leather an emery coating. On these revolving buffs the article is held and polished. For small work, buffs of solid leather are used, and these may be turned to a sharp edge, so as to reach the finer parts of the ornamental work. The articles thus treated are ready for the final polishing by revolving dollies, made of a large number of circular pieces of calico very securely bound together in the centre with screw and nut. A preparation of 2 parts of flour emery powder and 1 part of crocus powder, mixed with boiling suet, should be left to get cold, and then cut into oblong cakes. It is used on the dollies, against which the brass and copper articles are held and polished. Some buffs are also made of a composition of felt, but leather produces the best effects.

Polishing Brass Tube.—Brass tubes are prepared for polishing by being floated with a file, the teeth of which act as cutters and take off the top skin of the metal. Instead of floating, the plan may be adopted of grinding with an emery wheel of about 150 fineness. This wheel, 12 in. in diameter, is fixed on the end of the polishing spindle by means of a false nose, the wheel being held in place by a nut screwed tight on the end of the thread of the spindle. On the bench is fixed a large compound slide-rest with an arrangement to carry the tube; a table is placed both in front and at back of the slide-rest to prevent the tube bobbing about. The advantage of the slide-rest is that any size of tube from $\frac{5}{8}$ in. to 2 in. may be ground by simply raising or lowering the tool-holder and the tube-carrier. The tube is placed on the carrier and adjusted till there is the slightest pressure or allowance for grinding by the wheel. The side of the wheel, not the edge, is used to grind with, and the tube is passed between the rest and the wheel, which takes off from the tube, with a circular motion, the thinnest possible amount of brass. Each side is served in this manner. Tubes are ground much quicker by this method than by hand floating. After grinding, the tubes are treated with ordinary sand and polishing sand, and finished off with the ordinary cotton mop and compo. The mops should be closely sewn together, the rows of stitching

being about $\frac{3}{8}$ in. apart. They are further strengthened by bolting together with four ordinary snap-head, square-shank, $\frac{1}{4}$-in.-diameter iron pins with nuts.

Preventing Brass Tarnishing.—All brass-work cleaned by the ordinary methods will become dull in a very short time; this is due to the action of the atmosphere. The only way to overcome this is by cleaning and lacquering. To do this, well clean the articles by boiling for about twenty minutes in a solution composed of $\frac{1}{2}$ lb. of caustic soda and 1 gal. of water. Well swill, and dry. The articles can now be lacquered either with a hot or cold lacquer. For the former a small stove will be required, heated preferably by gas, the size of the stove being gauged by the size of the work in hand.

Brassing

Brassing Iron and Steel.—There is not at present any known method of depositing brass on iron by simple immersion. Articles may be copper-washed by dipping them in a bath of copper sulphate that has been sharpened with acid, but for covering with brass the articles must be electro-brassed. Anyone who has the apparatus for electro-plating can readily do electro-brassing. It is said that a colour having some resemblance to brass may be given to small iron and steel articles by stirring them for a long time in a tub containing water 1 qt., and sulphate of copper and protochloride of tin crystallised, of each about $\frac{1}{2}$ oz. The colour of brass is given to iron by coating the surface with gold size, putting in a warm place till tacky, and applying bronze powder, or what is known as Dutch-metal powder, on a pad of soft leather. All methods of brassing iron other than that of electro-plating are in the nature of makeshifts, and are unsatisfactory.

Electro-brassing.—There can be no surer way of colouring iron and steel articles than by electro-brassing them. If they are free from rust, and highly polished, the process will be easy and expeditious. Obtain some dipping bowls of perforated stoneware, in which a hundred or more of the articles can be dipped and shaken in the preparing pickle to fit them for taking a coat of brass. The first pickle should be composed of $\frac{1}{4}$ lb. of zinc sulphate dissolved in 1 gal. of water, then add 1 pt. of sulphuric acid. The second pickle is composed of 1 lb. of potassium cyanide dissolved in 1 gal. of water. First immerse and shake the articles in the acid pickle for a few minutes, then well rinse them in clean water, immerse for a few moments in the cyanide pickle, and transfer them whilst wet to the electro-brassing solution (see below) to deposit the required coat of brass. If there are holes in the articles convenient for stringing on wire, they should be bunched on No. 24 soft copper wire, and suspended by this wire in the brassing solution. It will be advisable to do this bunching after the articles have been in the acid pickle and rinsed preparatory to immersion in the cyanide pickle, as they can then be passed through the latter and into the brassing bath without delay. If the articles have not any holes or projections around which the wire can be twisted, they must be brassed in a wire gauze vessel and shaken about in this whilst being brassed. After the articles are coated with brass they must be well rinsed in clean water, and shaken in hot sawdust until they are dried and polished, then lacquered whilst hot. The shaking process may be done in a sack or in a revolving barrel. If the articles need polishing before they are brassed, this may be done in the same barrel, using sand instead of sawdust to increase friction. The electro-brassing solution alluded to above is made as follows:—To make, say, 20 gal. of brassing solution, in a large stoneware vessel put 20 oz. of good sheet brass in narrow strips, and add dilute nitric acid in small quantities at a time; this should be done in the open air, or where a strong up-draught can carry away the poisonous fumes which arise. When all the brass has dissolved, add the solution to 20 gal. of filtered rain water, and stir into this enough liquor ammoniæ to throw down all the metal as a green precipitate and to dissolve this, forming a clear blue liquid. Into this liquid stir enough solution of pure potassium cyanide to take out all the blue colour; then allow it to stand for 24 hours before working. Use anodes of best soft sheet brass, and work with a six-volt current, either from four Bunsen cells in series or from a shunt-wound dynamo. For large surfaces large cells or dynamos should be used.

If a small current is employed, the desired thickness of brass will take a long time to deposit. A plating dynamo to give a maximum current of fifty ampères would be a useful machine for brassing work.

Brazing

Borax for Brazing (*see* main heading, Borax).

Brazing Band Saws.—The following are three methods of brazing band saws:—(1) File the saw on opposite sides so as to form two wedge-shaped ends with a lap equal to the length of three teeth. Clamp the saw in a suitable rest or holder, damp the ends of the saw, and for a 1-in. saw place between the lap about as much brass spelter and borax as can be held on a shilling. Get a pair of tongs bright hot, scrape off all scale from the jaws, close the tongs on the saw until the spelter melts, remove the tongs, and close quickly a pair of black-hot tongs on the braze. When the joint is well set, remove the tongs and file the braze to a thickness uniform with the rest of the blade. (2) Fasten the ends of the saw together with wire and hold the parts to be joined over a gas flame. This is not a good method. (3) Where a number of saws are being brazed, a small portable forge will be useful. File the ends of the saw as described above, secure the joint as near the ends as possible with iron wire, then bind with brazing wire the whole length of the lap. The saw is next placed in an iron clamp and secured with two hand vices; then moisten the joint with water and cover it with borax. Place the joint in the centre of the charcoal fire, and continue the blast until the brazing wire is melted. File the joint to the thickness of the blade, and finish with emery cloth. A very strong joint may be made by placing a piece of silver solder between the two parts. This solder is rolled into thin sheets, and a piece the width of the saw and the length of the joint is used. Neatness in a joint depends greatly on the condition of the tongs, the amount of spelter used, and how the ends of the saw are prepared.

Brazing Bell.—A cracked handbell could be brazed by gently heating it to a dull red colour, and then applying a little powdered borax at the part to be soldered. When the borax flows, take some grains of solder on the flattened end of a length of wire, place it along the crack with the flattened wire until all parts are joined, and on removal of the bell from the fire allow it to cool gradually. If the bell were soft soldered the continued vibration would probably cause separation.

Brazing Fish Hooks.—An ordinary mouth blowpipe, some brass spelter, borax, and a small camel-hair brush are required. File the parts to be united perfectly bright. Rub up a piece of borax in water on a slate, and apply the milky-looking liquid thus formed to the hook shanks with the brush. Fix together the hooks in their proper position by binding them with fine iron wire to a stout iron wire bent to shape. Expel the water from the borax on the hooks by placing for an instant in the blowpipe flame. Mix the spelter into a paste with borax-water and apply to the joint. If the spelter is in large grains, dip one in the borax-water and place on the joint. Direct the flame upon the spelter, and when this glistens and runs into the joint, stop blowing; if not sufficiently soldered, apply more spelter and borax and again heat. After brazing, the hooks will probably require to be re-hardened and tempered. They could be dropped into the oil whilst still red-hot from the soldering, and could afterwards be tempered to a blue or dark straw colour on a sand-bath.

Brazing Grey Iron.—The principle is first to decarbonise the grey iron for a slight depth. This is done by using oxide of copper or some other chemical that will have the same effect, together with great heat to burn or otherwise remove the carbon, after which the job can be brazed like wrought-iron.

Brazing Small Brass Articles.—Small articles of sheet brass are easiest brazed with a composition consisting of 5 parts copper, 3 parts zinc, and 2 parts silver. If the seams are not required to stand much working after soldering, they may be joined edge to edge. When seams are formed in this way, little nicks about $\frac{1}{2}$ in. apart should be filed out along the edges, so that the solder flowing through the nicks during the soldering operation will render the joint sound. If the seam is to be worked after soldering, a

HANDYMAN'S SET OF HOUSEHOLD TOOLS (2).

turnings in nitric acid until the latter is saturated—that is, until it will dissolve no more; immerse the brass articles in this bath, dry clean, and heat moderately over a clear coke fire, free from smoke. Repeat this process till the correct shade is obtained. (3) Another bath that gives a blue-black shade consists of 1 pt. of water, 5 dr. of iron perchloride, and 1 oz. of hyposulphite of soda. Dip the articles in the solution till they are of the desired tint, then swill, and dry in clean sawdust.

Brown Bronzing (Barbedienne).—White arsenic and tartar emetic (1 part of each) are dissolved in the smallest quantity of potash solution; the arsenic and the tartar emetic will dissolve more quickly in a warm than in a cold solution. When all the ingredients have been dissolved, make the solution just neutral (that is, allowing neither acid nor soda to predominate) to test paper by adding tartaric acid. Next add sufficient of a solution of ammonium sulphide to make the reddish-brown or yellow precipitate at the bottom of the vessel just barely dissolve. The solution is used warm, the brass being immersed, and the changes of colour watched. At first the colour will be golden yellow, and when a brown tint appears remove the article from the bath and scratch-brush; return the article again to the bath, and the real colour will be brought out. The solution must be fresh, or it will not work well. This bronzing bath may be renewed by the addition of ammonium sulphide.

Brown Bronzing.—(1) A brown colour may be obtained by dipping the articles in sulphuric acid or dipping acid, after having covered them with thin iron wire; this gives a pink colour, which may be toned down by brushing with blacklead or crocus powder. Lacquer the work with silver colour lacquer. (2) Dissolve 2 oz. of nitrate of iron and 2 oz. of hyposulphite of soda in 1 pt. of water. In this bath place the article till it is of the required shade; any shade from almost brown to red may be thus obtained. (3) Another bath that gives any shade from brown to black is composed of $1\frac{1}{2}$ oz. of perchloride of iron dissolved in 1 pt. of water. Immerse until the desired shade is secured.

Chocolate Bronzing.—The following describes how an old chandelier is bronzed. Boil the old lacquer off in a bath of carbonate of soda—about 1 lb. to the gallon of water. Dip in strong aquafortis quickly, and swill well in clean water. Immerse in a dilute solution of old aquafortis that has been previously used for dipping; copper nitrate or sulphate will do even better. Place some iron wire in the solution; in a short time the brass will become a salmon pink colour, due to a thin coating of copper; swill in clean water and dry out in box or beech sawdust. Then smear the parts over with a brush dipped in a paste made of red oxide of iron (Fe_2O_3) and water, with a little blacklead added. Now dry on a hot plate. When dry, well brush with a brush similar to those used for polishing grates. A circular brush fixed in the lathe would, of course, be better.

Copper Bronzing.—(1) The articles must first be boiled in a strong solution of soda to remove all lacquer and dirt, and then polished and washed clean. Now get a roll of fine iron wire; in the centre of this place the articles and dip in a vessel containing dipping acid (diluted sulphuric acid). Then wash off and lacquer in the ordinary way. (2) If it is desired to copper brass gas brackets, the best and most satisfactory method would be by electro-coppering them by means of a dynamo or some such source of electrical energy; but, unless conveniences were handy, this would be an expensive job. (3) Dissolve 2 oz. of nitrate of iron and 2 oz. of hyposulphite of soda in 1 pt. of water; dip the articles in this till the required shade is obtained. (4) The following solution will give any shade almost to a dark red. Well mix together $6\frac{1}{2}$ dwt. of potassium permanganate, $1\frac{3}{4}$ oz. of ferrous sulphate, $3\frac{1}{4}$ dwt. of hydrochloric acid, and $1\frac{3}{4}$ pt. of water; immerse the articles in this for a very short time, according to the tint required; dry in hot sawdust after well swilling in clean water. After bronzing, the articles should be lacquered with a pale lacquer. (5) One very good copper bronze consists of sulphate of copper 1 part, copper chloride 1 part, and water 20 parts. When all is thoroughly dissolved, add a little of a

solution of pernitrate of iron. This is a useful bronze for medallion work.

Florentine Bronzing.—(1) The goods must be cleansed in the potash solution, well rinsed in clear water, and dipped in aquafortis and well washed. Then put them for about five or ten minutes in a copper bath made up of 2 gal. soft water, 10 oz. sulphuric acid, and 3¼ lb. sulphate of copper. The bright colour may be darkened by using very dark Florentine lacquer or Canning's Florentine bronze, and then lacquering to suit. (2) Make a cream with a little jeweller's rouge and water, but previous to applying this the article must be coppered. After well cleansing the article, brush on the cream with a soft camel-hair brush, place on a warm plate, and when dry, allow to cool. Finally, well scratch-brush and lacquer the article.

Green Bronzing.—(1) Dip the brass in a solution of copper nitrate, heat on a hot plate till of a black colour, brush with blacklead, and lacquer with green lacquer. (2) Dip in an acid bath to remove all grease and dirt, then immerse in a bath composed of 1 part perchloride of iron and 2 parts water. This gives, according to the time of immersion, any shade from pale to deep olive green.

Steel Bronzing.—(1) To 1 pt. of water add 1 oz. of muriate of arsenic and boil. This must be used at a boiling temperature. (2) Dissolve 3 oz. copper sulphate, 3 oz. verdigris, and 1 oz. arsenic muriate, in about a quart of spent aquafortis. The articles should be dipped in this solution cold, and after the colour has been imparted they must be dried and lacquered with a transparent lacquer. (3) Get 1 qt. of strong commercial hydrochloric acid, 5 oz. of trioxide of arsenic, and 2½ oz. of copper sulphate. Grind up the copper sulphate, add to the hydrochloric acid, then add the trioxide of arsenic. Allow to stand a day or two, shaking frequently. Dip the work to be bronzed; colour it with old solution first. Burnish the parts that are to be left bright. Remove all grease with potash, and remove tarnish with sharp water. The portions that are burnished should be covered with copal varnish coloured with yellow chrome, and allowed to dry. Bronze in the above solution. When a suitable colour is obtained, rinse in cold water and dry out in boxwood sawdust. Remove the varnish on the burnished portions with turpentine; lacquer quickly, hot or cold. (4) The following instructions apply to steel bronzing brass wire. The nearest tint to new steel obtainable on wire is that produced by the potassium sulphide process. The lengths of brass wire must be made perfectly clean and bright, then given a thin coat of silver in an ordinary silver-plating solution, after which the wire should be dipped in a hot solution of potassium sulphide (liver of sulphur) until quite black, or brushed with the hot liquid, then rinsed in clean water, dried, and finally brushed with a soft brush to get the required lustre. The dark coat on this wire will not bear bending or rough treatment, as it will readily scale, and the wire should be lacquered if this is to be protected. A darker colour can be got by dipping the clean brass in a solution of platinum chloride, then washing, drying, and brushing as before. The coat is not more permanent than the other. A more permanent coat may be obtained by running the wire through a bath of molten lead, and thus giving it a thin coat of lead.

Steel-blue Bronzing.—First coat the brass thinly with tin or silver (*see* Tinning and Silvering), and lacquer this with a light blue lacquer to the required tint.

Bronzing Bronzes

Iron oxide is generally used for bronzing bronzes in which copper forms the greater part of the alloy. The iron oxide or rouge must be of special manufacture and should be neither too dark nor too light; an error in either direction will interfere with the finish of the article. The rouge is made into a cream with water, and the bronze is coated evenly and carefully with the mixture, which then is allowed to dry. When the mixture is dry, the bronze is held until it is black in the smoke of a lamp, after which the work is held in the flame until the black is burnt off. Then scratch-brush the bronze, and repeat the operation until the desired shade is obtained. When finished, the work must be lacquered with a pale

or colourless lacquer. The only alternative method to that which is described above is to mix with Zapon or colourless lacquer a little very finely powdered dry colour of the required shade. Apply evenly with a camel-hair brush, and allow to dry. Another coat of the colourless lacquer can be applied if the bronze is not bright enough.

Bronzing Copper

Antique Bronzing.—(1) Thoroughly clean the article; cover it with hydrosulphide of ammonia, and allow to dry. Then well brush with iron peroxide and plumbago or blacklead in parts, and afterwards with a waxed brush of medium stiffness; the brush should be frequently rubbed on a block of yellow wax, and then on the mixture of blacklead and iron. The variation in the shades may be altered by slightly warming the article after covering with the ammonia. (2) Mix together 20 parts of strong vinegar, 3 parts of carbonate of ammonia, 1 part of common salt, 1 part of cream of tartar, and 1 part of acetate of copper, all by weight, adding a little water. When well mixed, cover the article and allow to stand for forty-eight hours. Well brush the whole with the waxed brush as previously described. Various shades of colour from pink to black may be imparted by cleansing the article and, after dipping it into the solution, putting it into a receptacle and bringing in contact with sulphur fumes. Well brush with the waxed brush as before. (3) Dissolve in vinegar 2 parts of verdigris and 1 part of sal-ammoniac. Boil, skim, and dilute with water till a white precipitate ceases to fall. Boil the article in this solution briskly till the desired colour is obtained, then remove, well wash, and dry. The solution must not be too strong, or the deposit will not be permanent. The article must afterwards be lacquered with a colourless lacquer.

Brown Bronzing.—This is done in the way described under the heading, "Bronzing Bronzes" above.

Green Bronzing.—(1) To green-bronze copper goods, such as small trays, etc., steep them for a few days in a strong solution of common salt or sal-ammoniac. Well wash them in water, dry slowly, or suspend them over a vessel containing a small quantity of bleaching powder, and cover them. The depth of tone given to the articles depends on the length of time they are acted on. (2) To produce an antique green bronze, thoroughly remove all grease and dirt from the article to be bronzed, and then finish with a brass wire scratch-brush. Now make up the following solution: Vinegar 1 qt., sal-ammoniac 250 grains, common salt 250 grains, and ammonia $\frac{1}{2}$ oz. Small articles may be immersed in the solution and the liquid allowed to dry on them. When a green froth begins to form, spread it with a small brush to render the colour uniform. Dry with a second brush. Allow to stand for twenty-four hours before putting on another coat. After two or three coats have been applied, the colour is usually deep enough. Finally, dry the articles, and lacquer with a transparent lacquer such as Zapon. A very pleasing effect can also be obtained by using various bronzing mediums, such as antique bronze, peacock blue, green, etc.; these are known as lustre paints, and can be obtained in bottles from McCaw, Stevenson, and Orr.

Simple Immersion Processes.—(1) Copper can be bronzed by simple immersion in a solution of 5 drachms of nitrate of iron to 1 pt. of water. (2) For red, and every shade to black, use 1 oz. pearlash, 1 dr. sulphur, to 1 pt. water. For brown, and every shade to black, use 1 pt. water to 5 dr. of nitrate of iron. The addition of 2 dr. sulphocyanide of potassium makes this solution suitable for obtaining a dark brown colour. Or, for this purpose, 1 pt. water, 1 oz. sulphate of copper, 1 oz. hyposulphite of soda, and 2 dr. of hydrochloric acid may be used. A bright red may be obtained by using 1 pt. water, 2 dr. sulphide of antimony, and 1 oz. pearlash.

Tea-urn Bronzing.—A bronze similar to that on tea urns is produced (as already described) by thoroughly cleaning the surface and coating it with a paste of crocus powder and water applied with a brush, and then holding it in a sheet of iron over a clear fire for about a minute. A deep bronze can be obtained by substituting finely powdered plumbago for the crocus. Rubbing the metal with a solution of potassium

sulphide (liver of sulphur) produces, when dry, the appearance of antique bronze.

Bronzing Earthenware

The following explains how to bronze some stone (earthenware) jugs a copper colour. Digest together for several days with repeated shaking 4 oz. of gum dammar, 1 oz. of gum demi, 4 oz. of powdered ammonia soda, and 38 oz. of benzine. Mix the solution with 15 per cent. of its weight of deep bronze powder. Give the jugs two coats of this, and, when thoroughly dry, glaze over with a preparation consisting of 10 oz. of benzine, 4 oz. of gold size, and ½ oz. of French ultramarine. This should be thoroughly mixed before application. A bronze paint may be prepared by mixing in turpentine, with enough gold size to bind the colour, 8 parts of middle chrome, 6 parts of raw Turkey umber, and 2 parts of deep green; two coats of this will be found necessary. After the articles are thoroughly dry, they are finally glazed over with a little ultramarine mixed with gold size and turpentine. The most natural results are obtained by the process first given.

Bronzing Gun Barrels (*see* Gun Barrels)

Bronzing Gunmetal

The following solution is given by Hiorns in "Metal Colouring and Bronzing": Copper acetate, 200 gr.; iron oxide, 200 gr.; ammonium chloride, 70 gr.; water, 20 fl. oz. The metal to be coloured is pickled in the hot solution, dried, and heated on a lacquering stove for ten minutes. A very dark bronze—almost black—can be obtained by applying a weak solution of ammonium sulphide with a sponge, scratch-brushing, and re-applying the solution until a uniform coating of sulphide is obtained.

Bronzing Iron and Steel

Black Bronzing.—The article to be blacked must first be well cleansed from grease, and then dipped into a solution consisting of 1 part of bismuth chloride, 2 parts of mercury bichloride, 1 part of copper chloride, 6 parts of hydrochloric acid, 5 parts of alcohol, and 50 parts of water, well mixed together. When dry, place the article in boiling water for half an hour. If the black is not intense enough, repeat the operation. The colour is fixed by placing the article for a few moments in a bath of boiling oil, and afterwards heating till all the oil is driven off. This is said to give an intense black finish.

Brown Bronzing.—A common method is to use chloride of antimony. The chloride must be mixed with an oil, such as olive oil, to the consistency of cream. The articles are slightly heated, and the solution is evenly applied. The solution is allowed to be in contact till the desired shade is obtained. To hasten the action of the antimony, a little nitric acid mixed with the creamy solution is frequently used. Before applying the bronze, the articles must be thoroughly cleansed from grease and then well polished. In dipping, the articles would best be fixed on a wire, so that they will not touch one another. They might, when wired together, be heated in a small hot-air oven and then dipped, and allowed to dry when the colour is deep enough.

Green Bronzing.—(1) Mix together 1 pt. of methylated spirit, 4 oz. of gum shellac, and ½ oz. of gum benzoin; put in a warm place and occasionally shake. When the gum is dissolved, allow it to stand two or three days to settle, then pour off the clear liquid into another bottle and well cork. Procure some finely ground bronze green, the shade of which may be varied by the admixture of lampblack or yellow ochre as needed. Mix a little of the green colour with the varnish, slightly warm the articles to be covered, and with a soft brush gently lay on a thin coat. When dry, lay on another coat if necessary, and repeat till the articles are well covered. Then varnish all over with the clear varnish. (2) Well wash the articles in hot strong soda water to remove all traces of grease, swill in clean hot water, and thoroughly dry. Then, after polishing with ordinary blacklead stove polish, warm the articles in an oven until they are just too hot to handle, and coat with deep gold or amber lacquer. The right temperature is decided by just touching the articles with the knuckles or back of the hand. The articles must be held with tongs or a glove after blackleading, or the lacquer will not "take" where the iron is touched by hand. (3) This is suitable for iron gas-pipes. Clean the

pipes in dilute sulphuric acid, and lacquer them on a hot plate with green lacquer.

Bronzing Leather

To bronze leather in gold or silver, the leather must first be saturated with a solution of sugar of lead or cupric acetate, and then exposed to the action of hydrogen sulphide. The bronze may be applied by sponging on a solution, or by the galvanic process. In the former, the following solutions are used:—Gold bronze: 21 grammes of gold chloride solution containing 15 grammes of gold chloride; a solution of 20 grammes of soda in ½ litre of water; and 15 grammes of glycerine. Silver bronze: 10 litres of water, 100 grammes of silver nitrate, 65 grammes of ammonia, and 15 grammes of tartaric acid. Nickel bronze: 80 grammes of nickel nitrate, 80 grammes of ammonia, 3 litres of water, and 1 kilo. of Glauber's salt. Cobalt bronze: 1,000 litres of water and 1 litre of cobalt-ammonium sulphate.

Bronzing Plaster Casts

Assume that a cast coated with shellac and methylated spirit is to be bronzed. Do not attempt to remove the coating, but paint over it with oil paint of the same colour as the desired bronze, but slightly lighter. For a delicate cast, use tube colour thinned with turps, and stipple on with the end of the brush, as this will least fill up the moulding. Two coats may be necessary. When dry, go over with gold-size, and when this has so far dried as to be only "tacky," dab bronze powder on with a ball of cotton-wool. Set the cast aside till dried hard, then with a clean ball of cotton-wool lightly dust off all loose particles. To improve the appearance, projecting parts may be rubbed more, and for this moistening the ball with a drop or two of liquid ammonia will help. Varnish the whole with shellac varnish. In the various dryings, protect from dust.

Bronzing Steel (*see* "Bronzing Iron and Steel" on previous page)

Bronzing White Metal

(1) A simple method of bronzing is by blackleading the articles and heating them, then lacquering with green lacquer. (2) A simpler process would be to coat them with dead black. (3) The articles may be blued by painting with blue mixed in the best varnish; it should be carefully laid on, and then stoved. (4) For copper bronzing (according to an American method), the surface of the article is first subjected to the sandblast to produce a rough appearance. Now obtain a little finely powdered colour, of the requisite tint; if gold is desired, use gold bronze powder. Mix this with a little transparent lacquer, such as Zapon; this gives very good results, and is easy to use. Paint the articles over with the lacquer, and allow to dry. Then apply a coat of a colourless lacquer.

Bronzing Zinc

It is rather difficult to bronze zinc, but the following solutions are about the best: (1) For a dark brown colour, immerse in a solution of copper sulphate, 200 grs.; sugar, 300 grs.; washing soda, 2,000 grs.; and water, 1 lb., till of the desired colour; swill in water, and dry out in sawdust. (2) For a blackish brown, immerse as above in a solution of copper nitrate, 4 oz.; water, 1 pt. Finish by brushing with blacklead, then lacquer. (3) For iridescent mottled colours, immerse as above in a solution of copper sulphate, 200 grs.; cream of tartar, 200 grs.; washing soda, 1,500 grs.; and water, 1 lb. Blackleading is not required. (4) For re-bronzing imitation bronze figures (actually made of zinc), a mechanical bronze would probably be best. Obtain a bronze powder of a suitable colour, and make the articles perfectly clean. Then varnish the surface with japanner's gold size, and apply the metallic powder with a soft pad of leather. When dry, apply a coat of colourless copal varnish.

Bugle

Cleaning Bugle.—Make a bucketful of hot soapsuds, using rainwater and a soap that lathers freely, and to this add a pennyworth of liquid ammonia. In this well swill the bugle, using a mop as employed for lamp chimneys in order to get the solution well into the bell portion. Should this treatment fail to remove the scum from the

crook, try the effect of shot, fine ashes, or coal slack added to the water. The mouthpiece end should be plugged with a cork, and the bell end with a cloth, whilst violent shaking takes place. Swill out clean by putting the instrument under a stream of water from a tap.

Bugs

Ridding House of Bugs.—Bugs, having once fairly taken possession of a house, are extremely difficult to get rid of. Fumigation by burning sulphur is the best remedy, and in order that the fumes may reach, as far as is possible, every haunt of the insects, all paper should be stripped from the walls, loose plastering knocked away, and all loose mouldings, etc., removed. The room must then be hermetically sealed by pasting paper over all cracks and chinks round doors, windows, ventilators, fireplace openings, etc.; but the door giving egress from the room must be left until the sulphur is ignited and the operator has departed. The paper strips should, however, be to hand ready cut, and the paste-pot and brush also be held in readiness for the final pasting up. In order that the risk of setting fire to the premises may be reduced to a minimum, a sheet of iron (an old tea-tray will answer) should be placed on three bricks, and above the iron further bricks may be used as a support for an iron vessel—which should not be jointed with solder—in which the sulphur will be burnt. The quantity of sulphur required will depend upon the cubic capacity of the apartment to be fumigated; from 2 lb. to 3 lb. of roll or stick brimstone, broken into small pieces, will be necessary for every 1,000 cub. ft. of space. All being ready, a little methylated spirit is poured round the sulphur to facilitate lighting, and the spirit is ignited; the operator should then quickly leave the apartment and close the exit, sealing up all cracks and openings with pasted paper. The fumes given off by the burning sulphur—sulphurous acid gas—will soon destroy all insect life reached by them; but, as bugs will congregate in places which the fumes would not reach—namely, behind plastered partitions, behind skirtings, under floors, etc.—it is extremely difficult to eradicate them if they have obtained a firm lodgment. Constant war waged upon them, combined with thorough cleanliness, will, however, in the majority of cases keep them in check. Little can be done towards keeping bugs out of furniture placed in an apartment infested with the pests beyond making their likely-to-be quarters as unpleasant as possible with turpentine, carbolic acid, etc. Powdered naphthalene placed between mattresses will also act as a deterrent. A method of destroying bugs infesting furniture is to place dishes or trays, containing paraffin, in as many parts of the room as possible, and renew the oil when evaporated. Inject oil freely, with a syringe or small oil-can, into the interstices of the furniture, around the buttons on mattresses, and similar places where eggs are generally laid, and in a week few will be left for future operations. Treat all the rooms, if possible, in the same way and at the same time, as the vermin travel when they find their quarters uncomfortable. The receptacles can be removed from rooms that have to be used at night about an hour before use, and replaced the next morning. To make sure, repeat the process after an interval of a week, and few will be left. Bed furniture that is very badly infested may require a third attention, but if done well the first and second times this is not likely. When bugs are breeding in plaster, it is a very difficult matter to get rid of them. The bugs are easily killed, but the eggs remain and constantly produce a fresh supply. One method is to use good carbolic acid, washed on with a brush. It must be carefully applied, because it causes very serious burns if spilt on the hands; the walls should not be otherwise touched until the bugs disappear. If the bugs appear in patches of the wall, treat those portions thoroughly. Carbolic acid is perfectly safe as a remedy for bugs, and is thoroughly effective; but the acid will certainly spoil the wall paper. This, however, should be quite a secondary consideration, as the whole of the wall paper may probably have to be removed before the bugs can be reached. Another remedy is carbon bisulphide, which will not injure the wall

paper. This substance has a bad odour, which, however, soon passes off. The wall may require more than one application, because the bugs are probably breeding in the walls, and eggs are hatched at different times.

Burners, Gas (*see* Gas)

Busts, Papier-mâché (*see* Papier-mâché)

Butter

A household test for butter is that known as the spoon test, this being commonly used by analytical chemists for distinguishing fresh butter from renovated butter and oleomargarine. A lump of butter two or three times the size of a pea is placed in a large spoon and heated over an alcohol or Bunsen burner, paraffin lamp, or ordinary illuminating gas burner. If the sample be fresh butter it will boil quietly, with the evolution of many small bubbles throughout the mass, which produce a large amount of foam. Oleomargarine and process butter, on the other hand, sputter and crackle, making a noise similar to that heard when a green stick is placed in a fire. Another point of distinction is noted if a small portion of the sample be placed in a small bottle, and set in a vessel of water sufficiently warm to melt the butter. The sample is kept melted from thirty to sixty minutes, and then examined. If renovated butter or oleomargarine, the fat will be turbid, while if genuine fresh butter the fat will almost certainly be entirely clear. To carry out what is known as the "Waterhouse," or "milk" test, about 2 oz. of sweet milk is placed in a wide-mouthed bottle, which is set in a vessel of boiling water. When the milk is thoroughly heated, a teaspoonful of butter is added, and the mixture stirred with a splinter of wood until the fat is melted. The bottle is then placed in a dish of ice water and the stirring continued until the fat solidifies. Now, if the sample be butter, either fresh or renovated, it will be solidified in a granular condition and distributed through the milk in small particles, being, as it were, in its proper element. If, on the other hand, the sample consists of oleomargarine, it solidifies practically in one piece, and may be lifted by the stirrer from the milk.

Butterflies, Relaxing and Setting

Butterflies that have become dry must be relaxed before they can be set. Take an insect by the folded wings, using a pair of entomological forceps, and dip the body in almost boiling water, taking extreme care not to immerse the wings at their bases; then for a few minutes hold the wings in the steam. The specimen will then be relaxed and be ready for setting. Another method is to place the butterflies for twenty-four hours on damp sand (the bodies resting in grooves cut in the sand), to which a few drops of corrosive sublimate have been added, in a closely covered box or basin, over which should be laid a damp flannel. The insects will still be fairly stiff even after this treatment; but an entomological pin should be passed through the thorax, and the forceps placed between the wings at their junction with the thorax and allowed to spring apart gently (this operation appears to break some internal ligament); the specimen can then be set. This latter plan, although a longer process, is more satisfactory than the first-described method of relaxation, mainly on account of the tendency of the wings of a steamed insect

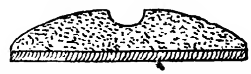


Fig. 154.—Section of Oval Setting Board for Butterflies.

Fig. 155.—Section of Flat Setting Board for Butterflies.

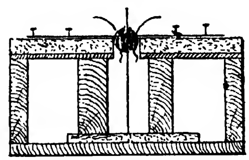


Fig. 156.—Section of Continental Setting Board for Butterflies.

to adhere to the setting board; butterflies of delicate structure should certainly be relaxed by the slower method. Setting is performed by pinning the specimen on to a setting board (see Fig. 154), and forcing down the wing with a stout bristle mounted at right angles to a strong needle by means of a small piece of cork, through which the bristle and the needle are passed. The wing having been brought flat with the board, a fine needle (mounted in a porcupine quill or other suitable handle) should be used to lever the wings upwards into position, which, generally speaking, is when the lower margin of the upper wing is at a right angle to the body, and the lower wing has been brought up so as entirely to shut off the lower margin of the upper wing. When this has been performed, strips of wax paper are substituted for the bristle, and secured by a sufficient number of pins. The antennæ should then be brought into position and held by pins passing through small strips of stiff paper. The insects thus set should be put away for at least a week to dry. Fig. 154 shows the oval setting board, Fig. 155 the flat setting board, and Fig. 156 the Continental setting board —all in section; the pins enter the cork, which is glued to the wooden base.

C

Cameo Carving or Cutting

For this work, says the "Horological Journal," the operator sits before a wheel turned by a pedal, his little tools, but few in number, occupying a small corner of the table surface, on which the worker's hands rest whilst the stone or shell is being held beneath the needle-like drill. The small tools resemble those employed by a dentist, and indeed it was from the cameo-carver's kit that the dentist got many ideas for his tools. The drills vary in thickness, but some are as fine as the point of a cambric needle. Near at hand is a china receptacle, containing oil and diamond dust, and into this the tools are dipped frequently during the progress of the work. Cameo cutting is very exacting, and usually the tension on his nerves prevents a person from putting in more than a few hours' work at a time. A quavering hand may, in a single stroke, spoil a week's work; the cutter must have sharp eyes and a delicate touch; he must be an artist and a skilled craftsman; he must know how to model and draw; and he must have some knowledge of chemistry, as offending spots have to be removed sometimes. The work is executed in relief on many kinds of hard and precious stones, but principally on the chalcedonic variety of quartz and on shells. Onyx, however, is preferred, because of its light and dark layers which throw out in relief a white head, say, against a black background. The picture is evolved by removing all that portion of white stratum remaining after the head has been completed. A portrait is executed on onyx in a month, but in a less time on shell; with the latter there is the danger of breakage, and as its durability is not great, shell is not so desirable for the purpose as are harder materials.

Camphorated Chalk (*see* Chalk)

Cane (*see* Bamboo)

Canvas

Priming for Canvas.—"Priming" is done by coating the bare canvas with white-lead ground in oil to which a little picture varnish has been added. As a background for a portrait, many artists paint in a subdued green or similar tint, always avoiding a "flat" uniform tone.

Repairing Cut in Canvas.—The following are instructions on repairing a cut, 3 in. long, in the painted canvas covering of a shed roof. If the canvas is over a close-boarded roof, and the slit is horizontal, cut a piece of canvas $\frac{1}{8}$ in. wider than the slit (say $3\frac{1}{8}$ in. square), then push the point of a trowel or something flat into the slit and upwards to free the canvas from the boards for a few inches. Give both patch and hole a coat of thick paint, and push the former about halfway under the upper edge of the slit. A few taps of the hammer will make the patch lie flat and close up the corners; then nail the edges down with copper tacks 1 in. apart, and paint again. If the slit is vertical, make a horizontal cut across the top 3 in. long, forming a **T**. Paint and tack the vertical portion and proceed as described above, making the patch long enough to cover the lower end of the slit.

Canvas-covered Boards for Artists.—Artists use millboards covered with canvas and painted white. To make these boards

proceed as follows: Get a thick straw board and, having cut to the required size, cut a piece of prepared canvas (this may be procured of all artists' colourmen) 1 in. larger each way than the board; now get some hot, strong glue, coat both the back of the canvas and one side of the straw board, bring the two into contact, and place in a screw press or under a heavy weight for a few minutes. The canvas overhanging is turned on to the back and glued down, and, to make a finish, a piece of thin tinted paper is cut (¼ in. smaller each way than the board) and glued over the back.

Capock

Capock is an unfamiliar substance to most people in Great Britain, but it is well known in parts of the Continent. It is in use in the English and German navies for the manufacture of life-saving appliances. Capock is the filamentous and downy envelope of the fruits of certain trees belonging to the family of the bamboos, and known in the Dutch Indies as the "false cotton tree." When the capsule of the fruit is open, it is found to contain a mass of yellowish-brown silky filaments which envelop the tender part, the pulp, of the fruit, like the stigmas of maize. This filamentous material is very light and scarcely absorbs water. After a maceration of several months its weight remains nearly the same, and because of this property it can be used as a substitute for cork in certain applications. It is said that a girdle of less than a pound of capock is sufficient to support on the surface of the water a man of ordinary stature. In France, this product has been advocated in medico-surgical therapeutics as a substitute for wadding or cotton for bandages and compresses in dressings.

Carbolic Acid

Carbolic acid (C_6H_5OH), known also as phenol, phenic acid and hydrate of phenyle, is universally used as a disinfectant. In its normal state it is in the form of long, colourless, prismatic crystals; but these at a temperature of 90° to 95° F. melt into an oily liquid known as liquid carbolic acid. In moist air the crystals deliquesce, forming a hydrate having a specific gravity of 1·065 and boiling point 370° F. Ordinary creosote consists largely of this hydrate. Carbolic acid is distilled from that part of coal-tar which distils over between 329° and 374° F. It is an irritant poison with a burning taste.

Carbon

Cutting Carbon Plates.—An old metal saw may be used, the carbon being moistened with water. A strip of hoop iron, or a disc of sheet iron, may be used, the latter being rotated. Wet sand should then be used in the cut. Another method is by scratching as deeply as possible, and breaking on the groove thus formed.

Carbon Paper.—The carbon papers that are used for duplicating purposes are covered with a preparation that is composed of lampblack or other black pigment, a wax, and an oily substance. The mixture may be made by melting together 6 parts of lard and 1 part of beeswax, and colouring by the addition of sufficient lampblack. The best preparation tried by an analytic chemist was composed of lampblack 5 parts, castor oil 5 parts, cerasin 1 part, and petroleum ether 10 parts. The wax should be melted in the hot oil and the lampblack stirred in; then, after removing from the fire, the petroleum spirit must be added. The addition of the petroleum spirit allows the mixture to be spread more evenly, and the coating is thinner when it dries. The lampblack is best used in the form of drop black, or lampblack ground in turpentine and the turpentine afterwards allowed to evaporate; or in place of lampblack, gas black may be used. These pigments are fine in the grain, and yield a smooth paper. The addition of a little Prussian blue gives a bluish-black shade, which will probably be an improvement. The aniline colours soluble in oils seem to be fitted for the purpose of making coloured duplicating papers either with or without the addition of cerasin wax; the latter would prevent the material taking off too easily.

Moulding Carbon.—As carbon cannot be melted to a fluid condition, it cannot be cast in a mould. But powdered carbon can be combined with a cementing sub

stance, made into a stiff paste, then moulded to shape, and baked. If the grain of the article is to be close and hard, the carbon must be ground to a very fine powder.

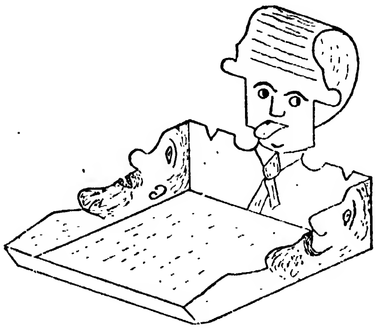


Fig. 157.—Flat Cardboard Tray.

It may then be made into a paste by adding sugar syrup or treacle. This paste is next pressed into a strong iron mould, so made as to be easily taken apart afterwards for the removal of the carbon article. The mould with its carbon must then be baked at a strong, bright-red heat, which will carbonise the sugar and cement the powdered carbon. It may be necessary to soak the carbon again in sugar syrup, and re-bake until sufficiently smooth and hard.

Carbonate of Soda (*see* Soda)

Cardboard

Covering Cardboard Boxes.—In cardboard box manufacture the ordinary method

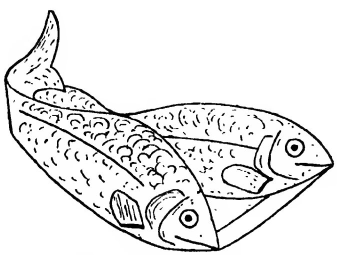


Fig. 158.—Bent Cardboard Tray.

of gluing the paper used in covering the boxes is simply by a brush. The paper is cut to size and laid flat upon the bench and glued with the brush. Glue brushes are much the same as paint brushes, and are to be obtained almost everywhere. For

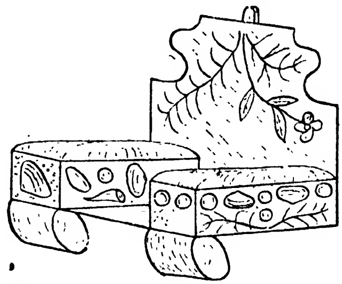


Fig. 159.—Cardboard Tray, Pin-cushion, and Watch-stand.

very small coverings, instead of gluing the paper a sheet of thin brass or zinc is glued and the paper laid upon it, one sheet at a time, and lifted again quickly; sufficient glue adheres to the surface to make it stick to the box. Some of the larger manufacturers now use gluing machines, sometimes called covering machines. The paper is on reels, and is drawn over a roller which rotates in a glue trough; by this means the paper is glued, the operator meanwhile covering the box. There is also an arrangement for cutting the paper when the four sides of the box are covered. The box is passed to another operator, who cuts the corners and turns in the cover at the top and bottom.

Cardboard Mounts, Gilding (*see* Gilding).

Cardboard Trays.—Figs. 157 to 160 show easily made trays. To make Fig. 157 draw a plan as shown in Fig. 161. The

Fig. 160.—Hanging Cardboard Tray.

front is 4 in. by $\frac{1}{2}$ in., the bottom 4 in. square, and the back 4 in. by $1\frac{1}{2}$ in. Lay

a straightedge from corner to corner of the square, as dotted lines, and draw two ½-in. lines at the lower corners. The sides measure 1½ in. at the back edge, and taper to meet the short slanting lines already mentioned. Make the handle strip 5 in. by 1½ in., with a slight projection at each side 1¼ in. up; cut away the corners at the extremity, leaving a piece ½ in. by ½ in.; also remove the circular and V-shaped portions from the back, and ornament the sides with fanciful

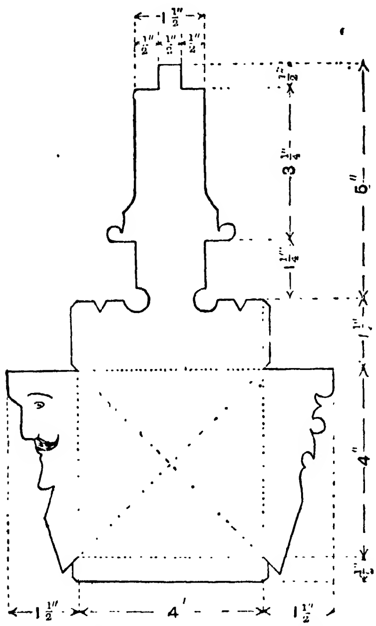


Fig. 161.—Pattern for Flat Cardboard Tray.

patterns or faces. Score the dotted lines, except those crossing the 4-in. square, and bend into shape, gluing the edges firmly together. Then draw a face on the handle, below the projections, make a ½-in. slit to represent a mouth, twist the handle round, and put the small end through the mouth, exhibiting a thrust-out tongue; glue it in position, and round the edges slightly. Add a collar and tie, and apply several bright colours to give a pleasing finish. Fig. 162 shows the method of producing Fig. 158. The front piece is 4 in. long and 1 in. deep; the bottom is 4 in. wide in front, 2 in. at the back, and measures 4 in. from front to back. The fish should be about 2¼ in. at the widest parts, the tails meeting 2 in. from the dotted back line. Score all dotted lines before bending, glue the front in a slanting position, bring up the pointed piece which lies between the tails, pinch the backs of the fish together to meet the pointed back slip, and fasten the three securely by means of sealing-wax. Bend the tails inward and glue them together to form a handle. Finish off with suitable colourings, giving more attention to effect than to accurate markings. Fig. 159 represents a tray, pin-cushion, and watch-stand

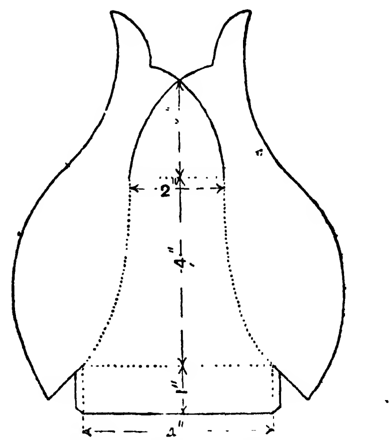


Fig. 162. -Pattern for Bent Cardboard Tray.

combined, and is cut according to Fig. 163, the bottom being 4 in. by 3 in., the back 4 in. by 4 in., and the side boxes 3 in. by 1 in. Bend at the dotted lines, glue the boxes to the bottom piece, and cut away the top corners of the back. Roll up two strips of card about 1 in. wide, and glue them under the front edge, causing the tray to slant backwards; then fix a wooden support, about 2 in. wide, at the back, letting a point protrude at the top for hanging a watch upon. To prevent the tray from tipping backwards, fasten a triangular wooden foot at the bottom of the back support, and fix a small leaden weight within each front circular foot. Fill the side boxes with bran, and cover with plush or velvet. Ornament with dried leaves or shells, sprinkling sand upon the background. Fig. 160 is suitable

for hanging up, and is planned as shown in Fig. 164. The dimensions are: Height 4 in., width 4 in., the sides being 2¾ in. wide, the bottom 2 in., the slanting front 1 in., the proper front 1½ in., and the top piece 1 in. Cut patterns on the sides and front, enamel the inside, and decorate the outside. Alternative edgings are shown in Figs. 160 and 164, but avoid variations in the same article.

needles instead of a shuttle. Real tapestry carpets are very scarce, what is generally known as tapestry being really an imitation Brussels. The pile or nap is left uncut, and the carpets are graded by wires. Thus, if a carpet is said to be a 7-wire tapestry, this means that seven loops of pile per inch are formed in the weaving, by inserting wires to throw the warp threads up on the face

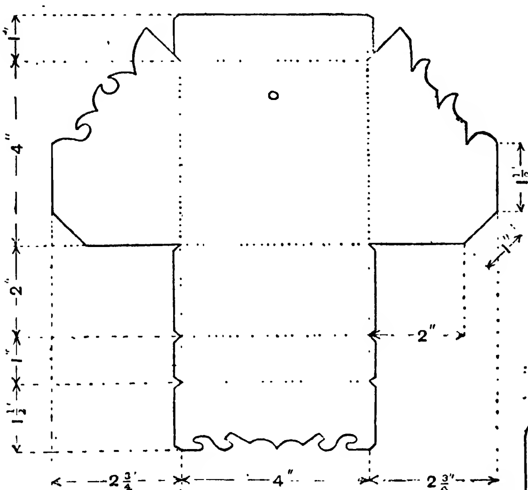


Fig. 164.—Pattern for Hanging Cardboard Tray.

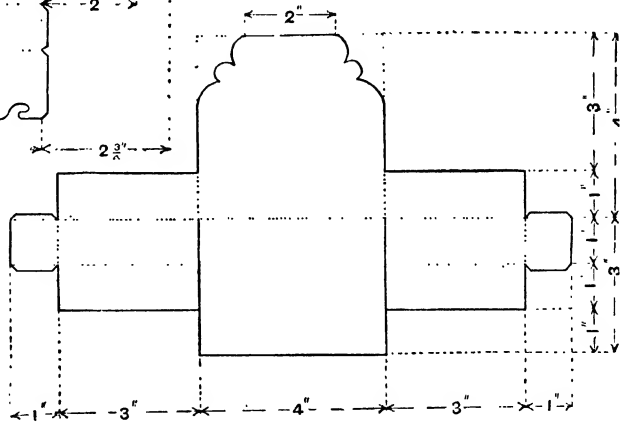


Fig. 163.—Pattern for Cardboard Tray, Pin-cushion, and Watch-stand.

Carnauba Wax (*see* Paraffin Wax)

Cornelian (*see* Stone Cutting and Polishing)

Carpets

The following remarks refer to the varieties and methods of grading carpets. Tapestries, if real, are not a woven fabric, but an intermediate between weaving and embroidery; they consist of a jute or hemp web foundation, the pile threads being put in with of the cloth. The more "wires" there are per inch the thicker the fabric will be. Brussels carpets have a clean-cropped corrugated surface, the rib being formed by a thick filling cord which runs across the width of the fabric; these carpets are graded by "frames," being known as 3, 4, 5, 6, or 7-frame Brussels. This means that a 3-frame carpet has three different colours in one row of loops, taking the warp way of the fabric; a 4-frame will have four different colours, and so on. Wilton carpets

have the same construction as Brussels, but the pile is left higher and then cut, which produces a very soft velvety surface. Wilton pile fabrics are used in immense quantities for upholstery purposes, and are then known as moquettes, and the grading for Wilton is the same as Brussels. Ingrain carpets are two single fabrics woven on the double cloth system, the bottom fabric being jute and the top woollen, or the better qualities may be both woollen. These are graded by "picks"; thus a 12-pick ingrain carpet will have that number of strands per inch showing on the face side across the width of the fabric. Smyrna and Turkey carpets are hand-made, and very coarse; the pile is formed by inserting loops and tufts of different coloured yarns on a linen or jute web or foundation. Texture and richness of colouring are the only guides in these

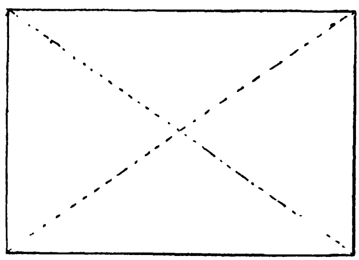


Fig. 165.—Carpet Planner's Room Plan.

varieties. Axminster carpets have a heavy terry or uncut pile, and these carpets are always of a thick and heavy weave—very soft to the tread, and in the best qualities they have exceptionally rich colourings and designs. Axminsters are graded by "wires" the same as tapestries. An immense quantity of printed carpets in imitation of all the standard varieties is on the market; they are usually of jute or union cloth dyed and printed in all shades and patterns. Borders to match roll carpeting are always procurable from the dealers. Brussels, Wilton, and Axminster carpets are woven 2 ft. 3 in. wide; Turkey, printed Kidderminster, and ingrains are 3 ft. wide; tapestries vary, the most common width being 3 ft., and stair carpets are made 1 ft. 6 in., 1 ft. 10½ in., and 2 ft. 3 in. wide.

Carpet Planning, Sewing and Laying.—Carpet planning is a work that requires careful measurements. It is customary to use a plan-book of stout paper about 1 ft.

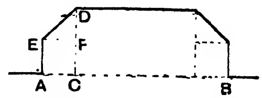


Fig. 166.—Carpet Planner's Bay Window Plan.

6 in. long by 1 ft. wide; the other necessaries are a 2-ft. rule, a 66-ft. tape measure, and a chalk line. Remove as much of the furniture as possible before taking measurements. First take the square plan of the room without taking into account any recesses, windows, etc., and mark down in the plan-book a rectangle, as in Fig. 165, carefully checking each measurement to prevent mistakes. Next take tape measurements from corner to corner diagonally; if these are not equal, the room is not square at all the corners. This should, of course, be shown as the result of the first measurements; if not, then they are wrong and should be corrected. Then fill in the details in the plan-book. For the fireplace have the curb placed in position, unless the hearth is tiled, when measurements should be made close up to the tiled border. Fig. 166 shows the method of planning for a bay window. Spring a chalk line across the opening indicated by the dotted line A B, then plan the line C D, and strike off E F, when the angle can be drawn in. The length of A B can be checked by adding up the distances between the offsets. In planning for circular windows, recesses, etc., it is necessary to take offsets at every foot (see Fig. 167), unless the curve is very quick, when measure at each 6 in. The length and position of each offset

Fig. 167.—Carpet Planner's Circular Window or Recess Plan.

should be clearly marked in the plan-book, when the segment can be drawn. Other irregular shapes are planned in a similar manner. Before cutting the carpet it is

advisable to make a scale drawing from the plan-book. The professional uses a special cutting floor, which is kept clean and used for no other purpose than laying cutting plans. The block plan of the carpet should first be laid in chalk lines on the floor, testing these with diagonals, as before explained, details of fireplaces, recesses, windows, etc., being filled in afterwards. Add all the measurements and check with the plan-book, as there is no chance of rectifying mistakes without wasting material after cutting is begun. First cut the borders, the centre carpet being filled in afterwards. The borders are mitered at each corner, the method of marking the mitres being explained in Fig. 168; the centre line will be the join, and the dotted lines are the cutting lines, the overlay being required for seaming. Pin the strips down, as cut, with a few drugget pins. Carpet borders are usually 1 ft. and 1 ft. 6 in. wide, and the cutting is done with a pair of stout 14-in. shears, a light wood T-square and a pointed piece of chalk being required for marking off square. The carpet is now laid in the centre, and particular care must be taken to match the pattern accurately. If the carpet has a decided floral pattern, have the heads facing the light, or at least in the opposite direction to the doorway. In cutting off allow 1 in. each way for seaming, unless the carpet has a plain woven selvedge, when 1 in. should be allowed at each end only. Mark each length of carpet and borders with consecutive numbers, and mark the same on the floor so as to facilitate each portion being sewn in its proper position; this work is generally done by female labour, the carpet-seaming machines on the market being expensive. The carpet is seamed by lap joins with strong carpet twist, and the edges and seams are bound with grey linen webbing. If the carpet has to be secured to the floor with rings which hook on brass-headed drugget pins knocked in the floor, the rings are sewn to the webbing at intervals of 8 in. all round the carpet square. When the seaming, etc., is done, the carpet is ready for stretching and pressing. To do this a carpet stretcher (Fig. 169) and a heavy goose iron are required. Place the carpet face down on the marked cutting floor, and it will be found that through puckers and wrinkles the carpet is a bad fit to the chalk lines. Therefore stand on the carpet, and with the stretcher held in front, work one side square and straight to the chalk line, then pin it fast to the floor with drugget pins, and stretch in the opposite direction, always beginning in the centre and working to the ends. Follow out the pinning down until the carpet lies square and straight with the chalk lines. Should any part be baggy or slack edged, it can be shrunk to shape by wringing out a cloth in cold water, placing this on the slack part, and ironing with the hot goose iron. All the seams should also be well pressed, and the carpet left overnight to set, when it must be well swept and the pins removed. Before the carpet is laid, examine the floor for projecting nail heads or knots in the wood; the former must be punched in, and the latter shaved off with a plane, a rounded iron being used to prevent digging at the corners. Felt underlays and surrounds are sewn together and cut to shape afterwards, any slack parts that may occur being damped out. Seams across the widths of the carpet are scratched out with a steel comb, and sewn together one on the other, the pattern being matched as accurately as possible; such seams are never used in first-class work. Stair and corridor carpets are never planned to fit, the method

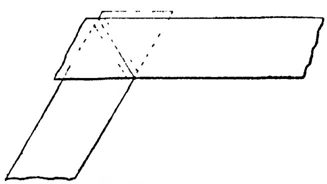


Fig. 168.—Mitering Corner of Carpet Border.

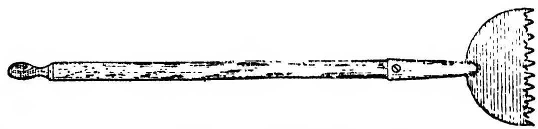


Fig. 169.—Carpet Stretcher.

being to take the roll to the house and lay it in position, afterwards cutting and binding the ends with webbing. For winding stairs it will be necessary to cut out pointed pieces to get the carpet to sweep the curves. In doing this allow for turnings, and fray the edges and seam on the wrong side. The seam should lie as close to the joint of the treads and risers as possible, as protuberances in stair carpets are dangerous.

Cleaning and Renovating Carpets.—The following method of cleaning and renovating carpets has been adopted with great success. The carpet is first thoroughly freed from dust. This can be best effected by hanging the carpet over a frame similar to the one shown in Fig. 170. The frame is made of common deal, the two uprights being 10 ft. long by 4 in. wide by 3 in. thick; the rail across is about 3 in. square and 12 ft. long. The uprights are driven into the ground to the depth of about 2 ft., and stays are fixed at each side to hold it firmly in position. The rail should have a hole bored at each end to allow for a thin rope being passed through. This rope works in pulleys fixed in the sides of the uprights at the top, and allows the rail to be either lowered or raised, which will be found very convenient when heavy carpets are being handled. The rail is lowered to receive the carpet; then, by hauling on the ropes, it is raised till the carpet clears the ground, and is kept in position by twisting the rope round a large nail driven into the uprights. The carpet should be beaten till thoroughly free from dust. Malacca canes about 4 ft. long are very suitable for the purpose, being tough and not easily split or broken. When this is done, lay the carpet out on a clean and level floor, and brush all over with a fibre carpet broom. To clean the carpet, obtain some benzoline, soft soap, and an ordinary flat scrubbing-brush; dip the brush in the benzoline, and apply just a touch of soap; then vigorously scrub the carpet. Work on a space of about 2 ft. square each time, till the whole carpet is covered. This treatment will clean and revive the colours in the carpet wonderfully; and as the benzoline evaporates very quickly, the carpet will be practically dry as soon as finished. Hanging the carpet in the open air for a few hours will free it from all smell of the benzoline. Another method is to have ready a pailful of warm water, two clean flannel cloths, a piece of white curd soap, and some turpentine in a shallow tin. Dip one of the flannels in the water, wring out and moisten it with turpentine, then rub on a little soap and commence rubbing the pile of the carpet in one corner of the room. Clean a portion about a yard square in this way, then wet the other flannel and rub over the cleaned portion several times to remove the soap. Proceed

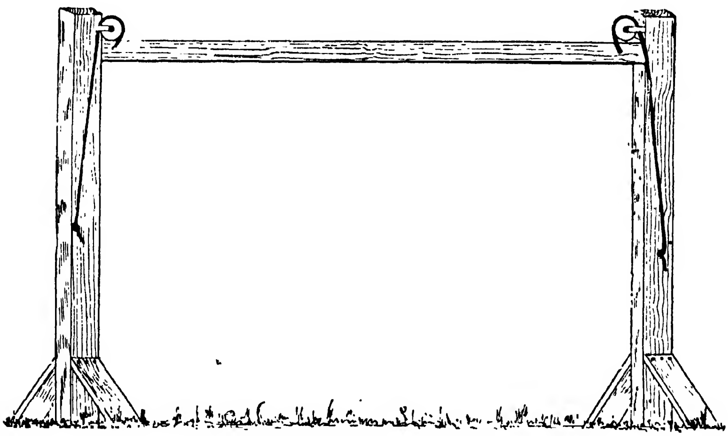


Fig. 170.—Frame for Hanging Carpet.

in this manner all over the carpet. Carpets can be revived by well beating and wiping over with ox-gall and water—one ox-gall to a pail of water. Where the colours have partly perished the following method can be tried. Well beat all dust from the carpet and stretch it on a level floor. Procure some packet dyes such as Judson's or Diamond brand; dissolve each colour in hot water in a separate vessel and brush them over the colours in the carpet with bristle brushes, which must not be too stiff. Give as many coats as necessary, allowing one coat to dry thoroughly before applying another. The colours will be found to dry considerably lighter than when applied. Another method of treating a faded carpet would be to have it dyed a self colour, such as marone, brown, or dark blue.

Dry-cleaning Carpets.—In the so-called "dry-cleaning" process, the carpet is first passed through a combined beater and brushing machine, which, however, does not remove the stains. The carpet, or such portions as need scouring, may then be placed on a flat bench or trestle table; a big pad of soft rags is made, damped with commercial naphthalene, and rubbed vigorously on the stained portion, which is then rubbed dry with a wad of clean cotton waste, frequently teazed or pulled out to present a clean surface to the carpet. This method is now regarded as wasteful, and is being superseded by the compressed air system. In this process a high vacuum is formed by an air pump driven by power. The suction of air is carried through armoured rubber hose to a suitable foot-piece; the latter is passed over the surface of the carpets, and the dust and dirt are sucked up through the tubes and discharged into a settling chamber. The nap of the carpet is also raised by this treatment. Carpets which are much sullied are submitted to "shampooing," being passed through a machine which crops or cuts the top of the pile surface, thus exposing the original colour of the yarns. Cleaning carpets by any method in which moisture is used is apt to make the colours run and present a patchy appearance. When sweeping thick-piled carpets, always work in the direction of the pile.

Carriages, Care of

When a carriage is new or newly varnished, it should stand for a few days, and be frequently washed and well dried off before being used. Frequent washings with cold water and exposure to fresh air in the shade will also help to harden and brighten its finish. Mud should not be allowed to dry upon a newly varnished carriage, or spots and stains will result. While washing a carriage, keep it out of the sun. Have the lever of the "set" covered with leather. Use plenty of water, taking great care that it is not driven into the body, to the injury of the lining. Use, for the body panels, a large, soft sponge; when saturated, squeeze this over the panels, and by the flowing down of the water the dirt will soften and harmlessly run off. Care should be taken to wipe the surface quite dry with soft chamois leather after each washing. Leather-top carriages should not stand long in the carriage house with the top down. After raising the top, "break" the joints slightly, to take off the strain on the web-stay and leather. Aprons of every kind should be frequently unfolded, or they will soon spoil. As a general rule, a carriage will retain its freshness better when gently used than if allowed to stand for long periods in a coachhouse. If the latter be necessary, draw the carriage out frequently to air, in some shady place, and occasionally wash it. A carriage should be repainted, or at least touched up and revarnished, as often as once a year; and the work should not be done in a hurry. In washing a carriage apply the sponge to the under parts and wheels as well as the body, but use a different sponge. Do not use a "spoke brush," which, with the road grit, would act like glasspaper on the varnish. Do not allow water to dry of itself on a carriage, as it invariably leaves stains. Hot water or soap should not be used in washing a varnished surface. Enamelled-leather tops and aprons should be washed with very weak soap and water; enamelled leather should not be oiled. In cleaning brass or silver parts, do not use acid, mercury, or grit; the polish should be obtained by friction solely. The examination of a carriage should be frequent and thorough. When-

ever a bolt or clip appears to be getting loose, tighten it up with a wrench, and always have little repairs done at once. Should the wheel tyres get at all slack, so that the joints of the felloes become visible, have them immediately contracted, or the wheels may be permanently injured. Examine the axles frequently; keep them well oiled, and see that the washers are in good order. Pure sperm oil is considered the best lubricant; castor oil will answer, but do not use sweet oil, as it will gum up. Be careful, in replacing the axle nuts, not to cross the thread or strain the nuts. Keep a small bottle of black japan and a brush handy to renovate the steps when worn by the feet, and also the edges of the tyres; lay on the japan as thin as possible. Carriages should be kept in an airy, dry coachhouse, in which there should be a moderate amount of light; direct sunlight should not be allowed to strike upon the carriage. There should be no communication between the stable and the coachhouse; and the manure heap or pit should be placed as far away from the carriage house as possible, because the ammonia fumes crack and destroy varnish and fade the colours of the paint and lining. The carriage should not stand near a brick wall, as the dampness from the wall will fade the colours and destroy the varnish. Whenever a carriage stands unused for several days, it should be protected by a large cotton cover, sufficiently strong to keep off the dust, without altogether excluding the light. Dust, when allowed to settle on a carriage, eats into the varnish. Care should be taken to keep this cover dry.

Casks and Barrels

Cleaning Beer Barrels.—Beer casks are generally steamed out. They are first well washed with water, then a flexible metal tube attached to a boiler is placed in the bung-hole and steam is blown through; this treatment kills any fungous spores, and therefore prevents mould growing. Another treatment is to well rinse with a solution of sulphurous acid or bisulphite of lime every part of the interior of the barrel, and then to wash it out. Still another method is to take out the head of the cask, first marking with a punch the end of a stave, and also the head opposite, so that it may be returned to the cask in exactly the same position as before. Clean the cask with cold water and a little soda, using a hard brush, and finish off with warm water and soda if thought desirable. If any smell remains, it may be necessary to take off the staves separately and shave the inside of each, then replace them. The heads would also be taken out and served similarly. If any fungous growth exists after the heads are in, the first or second method given above must be tried, finishing by rinsing out with water.

Fitting Iron Hoop to Cask.—Measure round the cask and get one rivet in first, and, having punched a hole for the second rivet through the top side of the hoop that overlaps, drive on fairly tight, which will give the taper. With the hoop in position, mark through where to punch the other hole for the second rivet, to fix which the hoop must be removed from the cask. The hoop is finally driven down tight on the cask.

Preserving Casks.—A preservative for wooden casks, from putrefaction and from insect ravages, is a composition made by melting together 16 parts by weight of tallow, 2 parts of yellow wax, 3 parts of colophony, 3 parts of vitreous sand, $\frac{1}{4}$ part of arsenic, and a small quantity of a suitable pigment. Two coats are needed of the preservative, which should be used cautiously, as it is poisonous. Do not use such a coating when the cask is to contain anything that is to be taken into the human system.

Replacing Head in Cask.—The following explains how to replace an undowelled head (removed for cleaning purposes) in a cask. Put the pieces of the head in the same positions as they were originally. Nail a strip of wood across the joints to keep the pieces together, taking care that the nails do not go quite through. Return the head to the cask in the same position it was before being taken out (the position should have been marked with a punch or chisel). If in doubt, look for the impression that each stave makes on the head. Take off sufficient hoops to allow the staves to spring open, place the head in the cask and pull towards

you, the cask lying on its side; tighten the hoops sufficiently to hold the head in place, and any portions that refuse to come into the groove easily can be lifted in by means of a thin but blunt table knife or a thin piece of iron inserted between the joints of the staves; a small rush as used by coopers, placed all round the groove, would make doubly sure. To peg the head together, in one piece of the head at 4 in. from each end bore a hole, then place a piece of chalk in the holes bored and rotate for the purpose of marking the inside edges of the hole. Place this piece of the head on the top of the next piece in the position required and then strike smartly with the hammer once, when an exact imprint of the hole will be seen on the piece underneath. Bore the holes out with brace and dowelling bit and fit the dowels to the holes tightly, then proceed with the other pieces in a similar manner.

Casting (*see* Plaster Casting)

Castors, Bedstead (*see* Bedstead)

Cell (*see* Electric Batteries)

Cellulose

Cellulose is a product of the growth of plants, and cannot be prepared artificially. The purest forms of cellulose are cotton-wool and bleached linen fibre; wood and paper also consist very largely of cellulose. It is the base from which celluloid is prepared.

Celluloid

Celluloid is prepared from pure varieties of cellulose—that is, white paper, cotton-wool, or wood pulp. The material is placed in pots or vats, and is submitted to the action of a mixture of nitric acid (sp. gr. 1·4) and sulphuric acid (sp. gr. 1·84) for about half an hour. The acid is then drained off and the nitrated cellulose thoroughly washed with water. The temperature rises during the nitration, and must be kept down by circulating cold water round the vats. The cellulose is then bleached by a solution of potassium permanganate, followed by hydrochloric acid, then thoroughly washed, and dried at a low temperature. The nitrated cellulose is broken into fragments in a machine, mixed with camphor and methylated spirit. In a few hours the mixture forms a stiff jelly, which is warmed and rolled out into a cake; it is then put in a hydraulic press and compressed into a perfectly solid block, which is subsequently cut up into thin sheets with planes or saws moistened with steam. The cut leaves are dried in rooms at about 90° C. in a current of air. For white celluloid, whiting or oxide of zinc is incorporated with the material before rolling. An ivory white is obtained with a trace of ochre or other yellow colour in addition. Practically, celluloid and xylonite are identical.

Celluloid Coatings on Wood and Metal.—In the one case these coatings show to greater effect the beauty of the grain, and in the other prevent the formation of rust. Wood veneers have been coated by machine with a very thin layer of polished celluloid, the grain of the wood thus becoming more prominent. The celluloid may be quite transparent, in which case it presents a more durable polish than the ordinary shellac surface applied in french polishing. Celluloid and similar preparations are now applied to bicycle parts as a rust preventative, the medium for the celluloid being acetone, acetic-ether, etc. The solution, tinted with metallic colours, is brushed on again and again, or the bicycle parts are dipped repeatedly into the solution, which is at a temperature of 104° F. (40° C.), until a sufficiently thick coat, of the nature of an enamel, is formed.

Cementing Celluloid.—Cement for celluloid is made by dissolving celluloid chips in acetone to form a thick syrup; this is applied to the parts to be mended, and put under considerable pressure till the solvent has evaporated and the cement becomes hard. A good cement for uniting celluloid to paper, linen, wood, and metal can be made by covering gelatine with strong acetic acid, allowing to stand overnight, and then melting down by a gentle heat. This cement is not waterproof, so that by soaking in water the celluloid can be removed when desired.

Polishing Celluloid.—The high polish seen on celluloid articles is obtained by contact

with polished moulds. Celluloid cannot be polished by friction, as it is too soft. To produce a highly glazed surface on the articles, coat with white shellac varnish.

Rendering Celluloid Plastic.—Celluloid is softened by cutting it up, adding a small quantity of camphor, moistening with a sufficient quantity of methylated spirit, and keeping the whole in an air-tight chest. When the material has become soft, it is rendered plastic in a kneading machine. Celluloid can be rendered plastic by moistening it with camphorated spirit, or with acetone, allowing it to stand, and kneading it from time to time.

Solutions of Celluloid.—Celluloid dissolves in acetone, sulphuric ether, alcohol, oil of turpentine, benzine, amyl acetate, etc., alone or in various combinations of these agents. Some proportions for solutions of celluloid are :—(1) 5 parts by weight of celluloid, 10 of amyl acetate, 16 of acetone, and 16 of sulphuric ether ; (2) 10 parts by weight of celluloid, 30 of sulphuric ether, 30 of acetone, 30 of amyl acetate, and 3 of camphor ; (3) 5 parts by weight of celluloid, 50 of alcohol, and 5 of camphor ; (4) 5 parts by weight of celluloid and 50 of amyl acetate ; (5) 5 parts by weight of celluloid, 25 of amyl acetate, and 25 of acetone. A celluloid varnish is made by pouring 20 parts of acetone over 2 parts of colourless celluloid waste, and allowing it to stand for several days in a closed vessel, stirring frequently until the whole is a clear, thick mass. Add 78 parts of amyl acetate and put aside for several weeks to settle.

Cements

(For cements for various substances, *see* under name of the substance.)

Acid-resisting and Waterproof Cement.—Such cements are (1) shellac ; (2) shellac 2 parts, Venice turpentine 1 part, melted together ; (3) 19 parts of sulphur and 42 parts of powdered glass—melt the sulphur, stir in the powdered glass, and apply hot ; (4) powdered glass 1 part, powdered fluor spar 2 parts, and silicate of soda 6 parts. All these cements would have to be applied to the material and then dried, as they would not set under water like Portland cement ; they will all resist moderately concentrated acids and water.

General Cement for use in Collapsible Tubes.—The cements that are sold in collapsible tubes are made from (1) fish glue, (2) glue and carbonate of potash, and (3) casein with carbonate of soda. (1) Fish glue is a syrupy, sticky fluid that requires no further preparation. The rather powerful fishy odour is usually disguised with a little oil of cloves. (2) A fluid glue may be made by soaking 1 part of glue in 10 parts of water, and then melting down with a gentle heat ; one-eighth part of carbonate of potash is then added, and the mixture boiled for about an hour over a very slow fire. The boiling could best be done in an enamelled pan on a sand bath, which could be heated by a large Bunsen burner. The mixture should be carefully boiled, or it will char and be ruined. This glue remains fluid and is very sticky when cold. If not thick enough, it evaporates on the sand bath until the proper consistency is obtained. (3) A similar fluid cement can be obtained by boiling together 4 parts of casein, 1 part of soda ash, and about 10 parts of water.

Heat-resisting and Waterproof Cements.—A cement that is not easily acted upon by heat and water may be made by dissolving, by a gentle heat, 1 part of shellac in 5 parts of ammonia ; if the solution is too thick, dilute it by using more ammonia. A similar cement may also be made by dissolving 1 part of shellac in 4 parts of methylated spirit. A cement that can be applied hot may be made by melting together 4 parts of shellac and 1 part of Venice turpentine. It is not easy to find a transparent cement that will withstand boiling water, but No. 4 recipe in the paragraph, "Acid-resisting and Waterproof Cement," might be tried. A cement used for hot-water pipes consists of 1 part litharge, 2 parts chalk, and 3 parts silver sand, mixed with boiled linseed oil to the consistency of stiff putty. Yarn is used with this when making pipe joints. It might be mentioned that ordinary putty (whiting and boiled linseed oil) is often used in making joints between two pieces of metal, as it hardens and becomes very sound when heated a few times.

of the paste, besides helping to prevent decomposition. This recipe has often been published, and presumably is a good one. It is cheap enough for anyone to test.

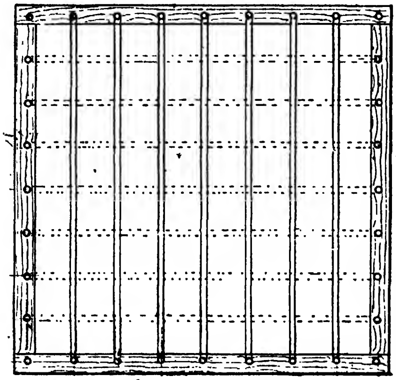


Fig. 172.—Diamond Pattern Chair Caning: First Stage.

Cerasin (*see* Paraffin Wax)

Chains, Cleaning

To clean gold or silver watch-chains, lay them for a few seconds in pure aqua ammoniæ, afterwards rinse them in alcohol, and finally shake in clean sawdust. Imitation gold and plated chains are first cleaned in benzine, then rinsed in alcohol, and shaken in dry sawdust.

Chains, Cycle (*see* Cycle).

Chairs

Brass-studding Chairs.—When a gap (generally caused through a faulty joint) occurs in a line of brass stud nails, the place should be plugged before putting on the banding. If the gap will not allow of this, place a small bottle-cork behind the banding and press the stud into the cork. This will give the appearance of a continuous line, and will hold for a long time with fair usage. In close-studding, a three-pronged punch is used to mark out the positions of the studs, but a sharp, fine stabbing awl is employed for boring for the stud shanks, and the studs are then driven in with the hammer. The method of driving brass edging nails, followed in London workshops, is to start them with their heads slanting slightly inwards towards the covering material. When the head of the nail is nearing the cover, it is gently knocked over level, no marking of position or boring of holes being required. Quite a moderate amount of practice will enable the worker to drive the nails in quickly and evenly, providing no attempt is made to drive them in directly downwards.

Caning Chairs.—The caning or re-caning of chairs is generally done with a species of split rattan cane, varying in lengths from 10 ft. to 15 ft.; it is sold by weight and is of two qualities, known as No. 1 and No. 2. The No. 1 cane measures approximately $\frac{1}{8}$ in. in width, and the No. 2 cane $\frac{3}{32}$ in. The quantity required will depend on the pattern adopted, and the ordinary six-strand diamond lacing will take about $\frac{1}{4}$ lb. for two bedroom-chair seats of the ordinary crown-back, ladder-back, or Oxford-back patterns. Before caning can be begun, $\frac{3}{16}$-in. (full) holes must be bored all round the seat frame with a brace and bit or a boring machine. These holes should be $\frac{5}{8}$ in. apart, and $\frac{5}{8}$ in. from the inner edges. Any staining and polishing of the frames should be done before the caning is begun. The

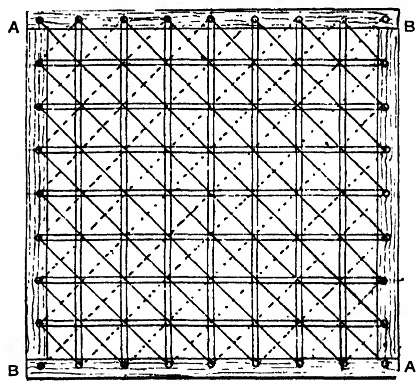


Fig. 173.—Diamond Pattern Chair Caning: Second Stage.

special tool required is a reamer (Fig. 171), a smooth steel spike, $2\frac{1}{2}$ in. long, tapering from a blunt point to $\frac{5}{16}$ in. at the tang, and firmly secured in a short hardwood

handle. A few hardwood pegs shaved from ½-in. stuff and about 2 in. long will also be wanted. Soak the cane for twelve hours in a tub of clean cold water, rain-water being

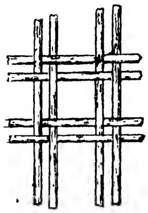


Fig. 174.—Chair Caning: Interlacing of Eight Canes.

preferable; this makes the cane pliable, and also prevents cracking and splitting when lacing. The cane will also contract on drying and make a firm, tight job. In the diamond lacing, the strands of cane square with the frame are of No. 2 stuff, and those running diagonally are of No. 1 cane. In Figs. 172 and 173 each separate line represents a strand, making six in all. In commencing work, place the chair on a bench or table, and pass up a strand of No. 2 cane through the centre hole on the chair front; then pass the other end of the cane up through the next hole, pull up both strands, and get them equal in length. Then cross the seat to the opposite holes and pass the cane down, pull it quite tight, and hold it with the left hand; insert the reamer with the right hand and press down. This effectually prevents the cane slipping until it has been laced to the opposite side,

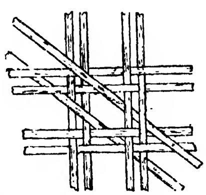


Fig. 175.—Chair Caning: Interlacing by Two Diagonals.

when the reamer should be transferred. Continue the single lacing to the last hole but one, then secure the cane with a hardwood peg and follow the same procedure with the other half of the cane, putting this through the same hole, thus making a double strand to each hole (see A, Fig. 172). The same operation is then done

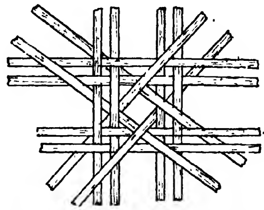


Fig. 176.—Chair Caning: Interlacing by Four Diagonals.

on the right until the seat is laced from front to back. The second lacing is across the seat from side to side, and is interlaced as shown in Fig. 174. In doing any lacing, always commence in the centre of the seat frame, as this ensures the strongest part of the cane being in the middle of the seat. Secure a loose end with a hardwood peg temporarily, as the next strand of cane passed through the hole will fasten it. The third lacing A (Fig. 173) is done with No. 1 cane, the lacing going from corner to corner across the centre of the seat, and being interlaced through the squares of double cane as Fig. 175. Next follows the fourth lacing as B (Fig. 173); this is in the opposite direction to the third lacing (see Fig. 176), and, if the caning has been properly done, will form the diamond pattern. The unsightly appearance round the holes is remedied by putting on a border cane. Select a stout No. 1 cane for the border and tie down with a piece of No. 2; double this in the centre and pass through

Fig. 177.—Bordering of Chair Caning.

the right-hand corner hole, double together, open the eye and slip the end of the border cane through, then pull down until tight. Pass one end of the tying-down cane up through the next hole but one, then over the border cane and down through the hole

again, the border cane being kept straight and free from puckers. Continue tying down at each alternate hole as shown by

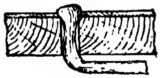


Fig. 178.—Section of Chair Seat Frame, showing Bordering of Caning.

the dotted lines in Fig. 177. In Fig. 178 is shown a section of the frame with the tying-down cane over the border. When the whole is laced, allow it to dry slowly, then brush up with a hard bristle furniture brush. Another pattern, called the "cross-square," and shown in Figs. 179 to 181, is very useful for nurse-chair seats, mail-cart sides, etc., as it makes a very close pattern, and is done entirely with No. 1 cane. It can be worked quicker than the diamond pattern, as the strands are not interlaced so much, and this will plainly be seen on referring to Figs. 179 and 180, which show the patterns for the first and second lacing. Six strands are used as before. Should other designs suggest themselves, they must be carried right through the different lacings, or a broken pattern will result. No varnish or polish is needed for finishing these cane chair seats, as the natural enamel of the cane would be difficult to improve. The above instructions also apply to re-caning old work, as the whole of the cane must be removed and the holes cleaned out before caning can be done. Discoloured and baggy seats can be renovated by well swilling with boiling

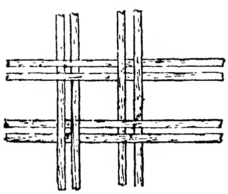


Fig. 179.—Chair Caning: First Stage of Cross-square Lacing.

hot water until the cane is thoroughly wet; then place the work in a strong draught of air to dry, and the subsequent contraction will bring up the seats tight and level. Do not use soda or soap in the water.

Remedying Loose Chair Rails.—Loose rails are a common fault in machine-made

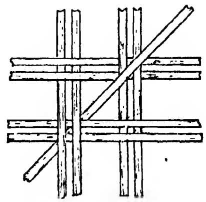


Fig. 180.—Chair Caning: Second Stage of Cross-square Lacing.

chairs. The fault is usually due to the dowels drying in or shrinking, and becoming loose in the holes. If the chair is to be stripped for re-upholstering, it is an easy matter to put in fresh dowels or fox-wedge the old ones and then glue up and cramp till dry. But if the chair is not to be re-upholstered, a good firm job can be made by fitting on chair braces at the joints; these braces can be obtained in a variety of patterns. Fig. 182 shows a common angle brace, which is screwed to the under side of the seat rail and inside the back leg. Fig. 183 shows a brace to be driven in at one end and screwed at the other. An ordinary dog brace could also be used. There is also a special brace that clips three sides; this is known as Rubery's patent chair brace,

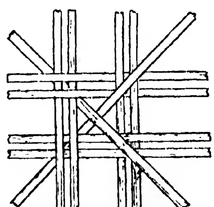


Fig. 181.—Chair Caning: Finished Cross-square Lacing.

and can be obtained from most ironmongers and hardware stores.

Re-seating Chairs with Rush or Cord Bottoms.—First carefully remove the four thin battens which are nailed on the edges

of the seat, and pull off the old rush, dust, etc. The sides of the seat frame are sunk slightly below the corners, so that the work will be flu h with the corners when finished. The work proceeds from

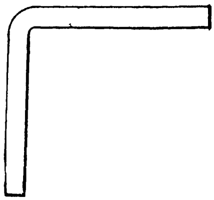


Fig. 182.—Angle Brace for Loose Chair Rail.

one corner regularly round to others in succession, ending in the centre, so that all four sides are worked together, as shown in Fig. 184, in which A, B, C, D are the sides of the seat frame. Have a good coil of cord on a stick, and make the end fast to the leg E (right-hand back corner), pass the coil up and out over A, then up and out over B, over C and up and out over A, then over D and up and out over C, etc. This will be quite clear from the cord shown loose in Fig. 184. When pulled up snug and tight and as the work proceeds it will have the appearance at each corner of that at the corner F. Any joining of the cord or rushes must, of course, be done after a back turn, so that it will come underneath. Stuffing can be pushed in between the upper and lower layers of cord as the work proce ds, and the end which is first hitched to the leg can be knotted and afterwards cut off.

Repolishing Birch Chairs.—Birch chairs are often finished with spirit varnish dyed so as to alter the colour of the chairs to resemble walnut or mahogany. Where the chairs are most subject to friction by reason of constant usage, the varnish in time wears away, and shows up the original colour of the birch. This fault is bound to be more pronounced on chairs the original colour of which has been altered by means of dyed varnish, unless the precaution has been taken to strip off the old varnish entirely, so that a stain may be used that will strike into and amalgamate with the wood fibres. Unless this is done, the combined stain and varnish simply lies on the surface, and though chairs so treated may look very well when done, they will not stand rough or constant wear without the colour coming off and rendering them unsightly again in a short time. Better results are likely to be gained by stripping off the old varnish, cleaning up as new, and using a stain to give the colour desired. Afterwards polish and varnish with only just as much colour in as will ensure a pleasing finish.

Rush-seated Chairs, Cleaning.—Scrub the whole of the woodwork and seating with warm soapsuds, to which a piece of washing soda has been added, then allow to dry. The rush seats cannot be properly bleached in position, but they can be stained green. To do this, dissolve ½ oz. of green aniline dye in 1 qt. of hot water, then add ½ gill of strong vinegar; give the seats two or three coats, according to the depth of colour required. When dry, make a size of 1 oz. of glue to 1 qt. of water, and lay on a thin coat with a brush or sponge. The woodwork can be well rubbed down with a piece of old hair-seating or fine worn glasspaper, the light parts touched up with stain to match, and two or three coats of brown hard spirit varnish, stained to the required tint, applied. Or the woodwork can be french-polished.

Chalk

Chalk (carbonate of lime) is a soft white rock in a pulverous or only slightly consolidated state, being composed of minute

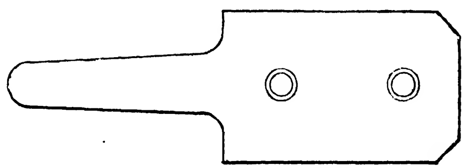


Fig. 183.—Chair Brace for Driving In and Screwing.

fragments of shells, sponge spicules, etc., as may be seen on examination with a microscope. As far as is known, chalk in large quantities is to be obtained only in the south of England and in the north of France.

Chalk as used in the industries under the names chalk, whiting, Spanish white, Paris white, etc., is prepared by grinding with water to a paste—the finer particles of which are then washed by a stream of water into a tank, where the sediment is subsequently dug out and dried. Quicklime is obtained by burning chalk.

Billiard Chalks (*see* Billiards).

Camphorated Chalk.—To prepare camphorated chalk, reduce $\frac{1}{4}$ lb. of camphor to a fine powder by triturating it in a mortar with a little alcohol; mix thoroughly with 1 lb. of precipitated chalk and $3\frac{1}{2}$ lb. of powdered orris root, and sift through finest bolting cloth. Another process of preparing camphorated chalk is to mix together 1 oz. of camphor and 15 oz. of precipitated or prepared chalk; the ingredients must be in the finest powder.

French Chalk (*see* Talc).

Liquid Chalk.—This is a handy thing to have on the bench where there is much work to lay out on castings or sheet iron. It is a mixture of chalk, glue, and water. Two-thirds fill a pint vessel with powdered chalk; add clean hot water until the vessel is almost full, and then add about two tablespoonsful of liquid glue, mixing thoroughly while it is hot. This is much more handy than solid chalk, as it can be put on with a brush in the same way as paint. It will not rub off in handling, and gives a nice surface to work on. The chalk must be powdered very fine or it will be rough when dry.

Precipitated or Prepared Chalk.—Precipitated chalk is very nearly pure carbonate of lime. It is prepared by choosing the very finest white chalk, grinding it to a fine powder with water, then mixing with water and allowing it to flow slowly through several tanks; the chalk precipitated in the tanks is of increasing fineness, according to the length of time that it remains in suspension, that which deposits in the last vat being the finest. After a sufficient quantity of chalk has deposited, the water is drained off and the chalk dried slowly in a heated room. A similar method of treatment is employed, as already mentioned, in the preparation of whiting, but the material is not so fine and white.

Chamois Leather

This is a soft leather, unequalled for polishing plate, glass, etc., and has been made from a special class of skins. Chamois skins get their name from the peculiar process by which they are prepared, and actually "chamois" is a misnomer, as the *Rupicapra tragus*, the chamois of the Alps of Southern Europe, was long ago superseded by the sheep of England, France, and Australia, as the chief source of the "chamois" skin. The chamois is a little animal not larger than a small goat, the largest seldom weighing more than 75 lb., and it is the only member of the antelope

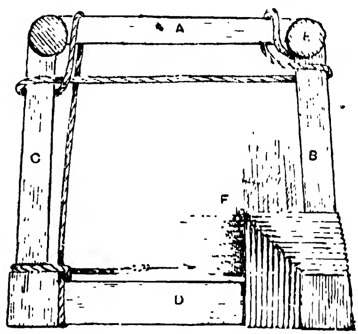


Fig. 184.—Method of Forming Rush or Cord Seat to Chair.

family remaining wild in Europe. Its skin is used almost exclusively for rugs and gloves, and is of exceptional value because of its very fine texture and its uniform thickness. In the latter respect it is superior to all other skins used for similar purposes. Its high cost and small size, however, are disadvantages which give the larger and nearly equally soft and durable sheepskin its opportunity. The doeskin, which has been stated to be the source of the best grade of "chamois," is not now used for this purpose, being more suitable for the manufacture of gloves. The part of the pelt of the sheep used as the "chamois" is the under skin, termed the "flesher," which was, until comparatively recent years, discarded as of little commercial value. This is secured by splitting the skin through the centre by a special

machine, and the upper of the two skins thus produced, termed the "grain" or "skiver," is used in the manufacture of thin fancy leather for bookbinding, portfolios, etc.

Charcoal

To make charcoal readily on a small scale, place small pieces of wood in a clay crucible, cover the crucible with wet clay, and heat in an ordinary fire for about an hour; thus all the volatile matter is driven off, and on cooling the charcoal will be found in the crucible. On the large scale charcoal is made by burning wood in great heaps or piles, covered with earth or clay, or in ovens or kilns to which only a limited supply of air is allowed access. Any

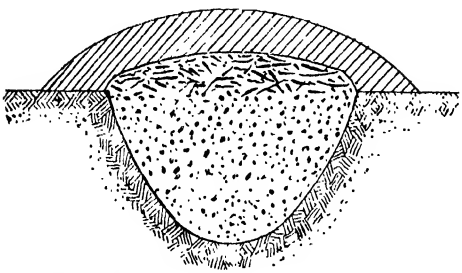


Fig. 185.—Section through Charcoal Pit.

kind of wood may be used, but the hard woods, such as oak, beech, and fir, produce the best and densest charcoal. In unskilled hands the following is considered better than the pile method: A pit 5 ft. in diameter at top and 3 ft. deep (*see* Fig. 185) is dug and a fire lighted in it; the wood for making the charcoal is cut up into small pieces, about $1\frac{1}{2}$ in. or 2 in. in diameter, and placed in the pit till it is nearly full. As the fire burns, the hot embers sink to the bottom, and fuel should be piled on and kept burning fiercely until the pit seems full of hot embers. Sufficient fuel, cut up rather smaller, say 1 in. diameter, is then added to raise the heap 1 ft. above the ground level, when the whole is covered over with any old sheet iron, and the earth dug out of the pit and thrown on top, taking care it is well covered. The pit is left for twenty-four hours to cool, and, when opened, will be found nearly full of charcoal, whose weight should equal about one-fourth that of the fuel used. Charcoal is also produced by heating wood in iron retorts, the volatile products, such as wood tar, creosote, and acetic or pyroligneous acid, being condensed in receivers and utilised.

Chemists' Show Bottles (*see* Bottles)

Chimney Cleaning

Chemical Chimney Cleaners.—The so-called chemical chimney cleaners are mixtures which burn rather vigorously; placed in a flue closed up by soot they might set fire to the soot and thus open up the flue, but they will not clean a chimney. The best plan is to have the chimney swept. Another, but less desirable, method is to set fire to the chimney by burning a large quantity of paper. Still less desirable methods are to blow in a quantity of steam while the chimney is cold—this condenses on the soot, and brings it down—and by exploding some gunpowder in the grate. The last method is dangerous, and both it and the steam method will fill the room with soot. By another plan, the fire is got into a bright condition, then a very thin layer of small coal is put on. On top of this is laid a whole stick of sulphur; this measures about 7 in. long by $1\frac{1}{4}$ in. diameter, and is perhaps better known as brimstone in the stick form. The stove is then closed up and the damper opened full. This method is of use with closed stoves only; it also answers to extinguish a chimney fire. With open grates some form of blower must be employed to make the draught sufficiently strong, but this is a necessary condition also with the packets of advertised chemical cleaners. The efficacy of the sulphur is said to be improved by placing with it one or two raw onions on the fire. One chemical soot destroyer examined by an analytical chemist was found to contain about 25 per cent. of common salt, 65 per cent. of nitre, and 10 per cent. of sulphur. Another composition (protected by patent 7820 of 1898) is as follows: $\frac{1}{2}$ lb. flowers of sulphur, $3\frac{1}{2}$ lb. chloride of sodium, 2 lb. potassium nitrate, $3\frac{1}{2}$ lb. cuprous sulphate, and 4 lb. muriate of ammonia. Red-ochre may be added if it is desired to colour the mixture.

All the ingredients must be thoroughly pulverised before mixing. A little is thrown upon the fire, and the gases given off by combustion destroy the soot.

Chimney Sweeping. — In the ordinary method of sweeping a chimney, the brush is put up the chimney and length after length of the rod screwed on as the brush is pushed up. A cloth is fastened in front of the fireplace if the grate is in a living-room, the rod passing through a hole in the cloth. Chimneys that cannot be swept by rods are cleansed by another arrangement. A ball attached to a cord is dropped down the chimney; a brush is attached to the other end of the cord, and the sweep, standing at the fireplace, seizes the cord and draws the brush downwards. Awkwardly constructed chimneys are provided with external soot-doors through which the rods or the ball can be inserted. Huge farm-house chimneys are commonly cleaned with a holly bush, which is drawn up and down the chimney as often as required. Tools can generally be obtained from plumbers or from builders' merchants.

China

Cements for China.—As far as is known, no cements that are suitable for mending china and earthenware can withstand boiling water for any length of time. But independently of this fact, a crack in a hot-water jug, even if cemented, would gradually extend by repeated heating and cooling. The white of egg and quicklime cement is a good one, and will resist hot water for some time. Mix the white of an egg with sufficient powdered quicklime to form a thin paste and apply it to the broken part immediately, as it sets very quickly. The very best cements for china are the oxychlorides of zinc and magnesia. For zinc cement take chloride of zinc solution of sp. gr. 1·5, and in each 100 parts dissolve 3 parts of borax, and then make into a stiff paste with zinc oxide. For magnesia cement take chloride of magnesium solution of sp. gr. 1·25 and mix to a stiff paste with magnesia. Both these cements are white; they gradually set as hard as stone, and are scarcely affected by boiling water. Another cement: Take ½ oz. of gelatine in small pieces, place it in a bottle and cover with strong acetic acid, and next day melt it down by standing the bottle in hot water. Warm the parts to be united, touch them with the melted jelly, and bind them together for a few days. Still another: Take 2 parts of isinglass and add sufficient water to cover it: when it is softened, pour off the water and replace it with methylated spirit; then melt it down by a gentle heat. Dissolve 1 part of mastic in a small quantity of spirit, and add 1 part of gum ammoniac. When the solution is complete, mix it thoroughly with the warm isinglass solution, and allow it to evaporate slowly on the water-bath until it forms a stiff jelly on cooling. This cement must be melted and applied warm.

Crazy China-work.—Jars decorated by crazy china-work, or china patchwork, form useful and ornamental vases, pot-pourri jars, etc. Take an ordinary brown earthenware stewpot, together with its lid, thoroughly wash them, and allow to dry. Cover the outsides of the jar and lid with putty to a thickness of ¼ in. or so. This putty is the ordinary material to be obtained at any oilshop, and may be made by well mixing 2 lb. of sifted whiting with ½ lb. of dry white-lead, and then making into a stiff paste with raw linseed oil. After standing for a few hours, work it up in the hands, and then it is fit for use. The miscellany of odds and ends with which the jar is decorated includes broken china, bits of crockery, coloured glass, buttons, shells, little pieces of flint, etc., and all these must be washed thoroughly, and allowed to dry before being applied; they should be broken up so as to be not more than ¾ in. in diameter, and are embedded in the putty just as fancy dictates; it is not desirable to make any attempt at producing a pattern. If the putty is allowed to bulge out between each piece of china, it should be touched up with gold paint when dry. It is a matter of taste; but, in the writer's opinion, gold paint does not improve china patchwork. Instead of the ordinary putty, a cement made as follows may be used: Stand a stone jam jar half filled with melted glue in hot water, and stir in whiting until the mixture is of the consistency of cream.

With this coat the article to be decorated and allow to dry. Thicken the composition by adding whiting whilst hot, and apply the paste to the already coated, but dry, articles. The china fragments are then embedded; this ground is affected by water. Besides vases, such articles as drain-pipe umbrella stands, flower-pots, plaques (having a papier-mâché or tinplate base), photograph frames, jardinières, etc., may be decorated in crazy china-work. In cases where the base is a very porous one, as, for example, an unglazed flower-pot, coat it

Fig. 186.—Pot-pourri Jar in Crazy China Work.

with common varnish before applying the putty.

Examples of Crazy China-work.—A pot-pourri jar or vase for a flower-pot is shown in Fig. 186. To make this vase, an ordinary brown earthenware stewpot is required. Give this a thorough washing and allow it to dry. Then cover it outside with a layer of good quality putty to a depth of about $\frac{1}{8}$ in. The decorating is most conveniently done by turning the stewpot upside down and raising the side being worked upon a couple of inches by means of a block of wood. Before beginning to lay on the putty, get together a stock of broken china, crockery, bits of coloured glass, etc., which must be well washed and allowed to dry. These should be broken about the size of a half-penny. The shape of the broken pieces is immaterial—in fact, the more rugged they are the better. These pieces are to be now arranged by pressing into the soft putty to a uniform depth (that is, as deep as the surface of the jar will permit). Allow about $\frac{1}{8}$ in. of putty between each bit of china where the putty will bulge out, and should be left so. Go entirely over the outside of both jar and lid in this way, and then set them on one side for the putty to harden. When dry, give the putty wherever seen a coat of gold paint, taking care not to get any on the bits of china. The inside of the vase and lid should now be enamelled in some light colour and left to dry. Fig. 186 shows the finished vase with the lid partly removed. A common penny tin plate makes the foundation for the plaques shown in Figs. 187 and 188. Take care to affix a wire loop to hang the plaque up by before laying on the putty. The diameter of the plaques, shown by Figs. 187 and 188, is about $6\frac{1}{2}$ in. Fig. 187 is made entirely of bits of china, whilst Fig. 188 has small iridescent shells in addition. A portion of a photograph frame is shown in Fig. 189. This is made of 2-in. by $\frac{3}{4}$-in. pine or deal, and a recess is cut down the centre, $\frac{1}{8}$ in. deep and $1\frac{1}{2}$ in. wide, for the layer of putty. The inside rebate measurement of a frame for a cabinet photograph is $10\frac{1}{2}$ in. by $8\frac{1}{2}$ in. The pine where seen should either be stained and varnished or else enamelled. The photograph will, of course, require to be mounted; to do this, cut a piece of white mounting board to measure $10\frac{1}{2}$ in. by $8\frac{1}{2}$ in.; in the centre of this cut a square opening $7\frac{1}{2}$ in. by $5\frac{1}{2}$ in. Cut it with a bevel edge; now take a piece of gilt or "flock" mounting board, and in the centre of it cut an opening $5\frac{3}{4}$ in. by $3\frac{3}{4}$ in. This must now be glued at the back of the white mount, taking care that both openings are exactly central and square. The complete mount will be rather thick, and will require a rebate at least $\frac{3}{8}$ in. deep in the frame.

Removing Burned-in Designs from China.—To remove burned-in designs from china without much injury to the glazing, rub

the surface with a piece of pumice stone moistened with strong hydrochloric acid; or rub with a cloth, wrapped on a stick to protect the hands, and thoroughly wetted with the acid. Then wash the surface with a strong solution of sodium carbonate or bicarbonate, and rinse in clear water.

Riveting China (*see* Glass).

Chinese Cement (*see* Cement, Schio Liao)

Chisels

Firmer chisels (*see* Fig. 190) are used for cutting away superfluous wood in thin chips. They are strong chisels, with iron backs and steel faces, the best being made of cast steel. For hand chiselling they are more used than any other kind. The stouter kinds are strong enough to resist the blow of a mallet. Paring chisels are longer tools (*see* Fig. 191).

Fitting Handle to Chisel.—For a chisel handle where hard and rough work is required, boxwood is best, but it must be carefully used, as it is liable to split in driving on. A hard, tough piece of brown ash makes a very good handle, that should last as long as the chisel. Beech is often used for the purpose, but will not stand much rough work. Yew is sometimes used, but it is rather liable to split. Apple-wood makes a nice-looking handle; but it is too soft to stand much knocking about. Hornbeam, laburnum and rosewood are sometimes used for tool handles. Having selected the piece of wood, the first job is to square it up roughly, then find the centre at one end by drawing diagonals and noting where they cross each other. Next fasten two strips of wood to two of the sides as shown in Fig. 192, and screw the block, together with the strips, in the vice. Then take the smallest pin-bit from the set, and bore a hole the full depth of the tang of the chisel to be handled. The two upright strips of wood will serve as a guide to keep the bit true with the block in boring. Now, with a hollow taper-bit—or wood-reamer, as it is sometimes called—taper the hole roughly to fit the tang of the chisel, until the shoulder is about $\frac{3}{4}$ in. from the handle; then with a narrow chisel square the hole and fit the tang in to within $\frac{3}{8}$ in. for an ash handle, or a little less for boxwood. A leather washer, as at A (Fig. 193), may be put on the tang to serve as a cushion between handle and shoulder, and this will

Fig. 187.

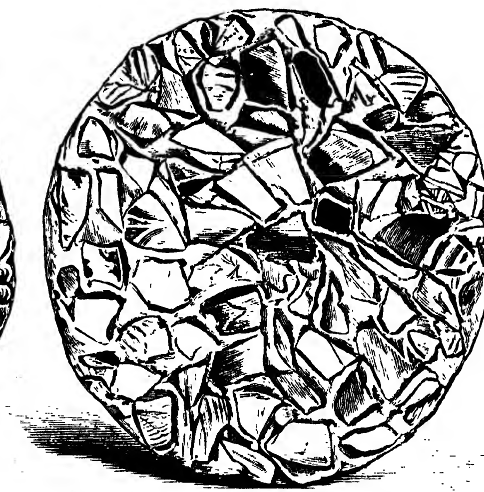


Fig. 188.

Figs. 187 and 188.—Plaques in Crazy China Work.

add considerably to the lasting properties of the handle. Next, put the cutting edge of the chisel on a cross-grained piece of wood, as at Fig. 193, and with a few smart knocks with a mallet drive home the handle. The next process will be to clean up the handle to shape. First taper it roughly with the axe, or mallet and chisel, frequently trying it on the edge of the bench or with a straightedge, as shown at Fig. 194, to see that the centre-line of the chisel is in alignment with the centre of the handle. Having roughed out the shape, plane it to the finished size, still trying occasionally, to ensure its lining correctly; then plane off the corners and round the top. A few strokes with the wood file, and a final rub with glasspaper,

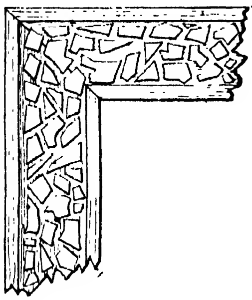


Fig. 189.—Corner of Frame in Crazy China Work.

will complete the job. The handle shown at Fig. 195 is an improvement on the old octagonal shape, especially for paring-chisels and gouges. The oval form fits the hand better, giving more command over the tool; and it is not much extra trouble to clean up the handle to this shape. Some workers finish the handle with a rubber of french polish. This gives it a nice appearance for a time, but it soon wears off. A better plan is to give an occasional rub with linseed oil. This, with the friction of handling, gives a lasting polish that improves with time.

Polishing Chisel Handles.—To supplement the information given in the last paragraph, it may be said that best boxwood goods are finished in the lathe, the polish being applied with a pad of wadding that has previously been used on flat work, so that loose fluff may not be given off. After applying a small quantity of polish, the handle is oiled rather sparingly, and a

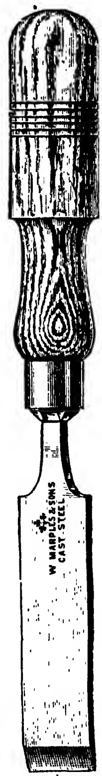


Fig. 190.—Firmer Chisel.

Fig. 191.—Paring Chisel.

handful of shavings left by the turner is held against it for the purpose of levelling and leaving a smooth surface for future operations; the use of glasspaper is thus avoided. The next rubber of polish is applied thinner, and repeated as often as necessary. Polish

for turned work consists of ½ pt. of methylated spirit, 1 oz. of gum sandarach, 1 oz. of seed lac, 1 oz. of gum benzoin, and 1 oz. of best quality beeswax, dissolved in sufficient turps to form a paste; carefully strain before use.

Cisterns (*see also* Tanks)

Finding Contents of Cisterns.—To find the number of gallons contained in a cistern, multiply the length, width, and depth together, all in feet. This will give the contents in cubic feet, which multiply by 6·23, and the product will be the number of

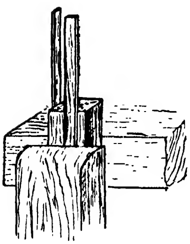


Fig. 192.—Chisel Handle and Guide Strips held in Vice.

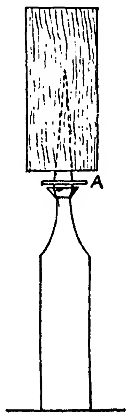


Fig. 193.—Fitting Chisel to Rough Handle.

gallons. If the dimensions are in inches, use ·003607 in place of 6·23. Two dimensions of a cistern to contain a given number of gallons being given, to find the third multiply the required number of gallons by ·16046 if the dimensions are in feet, or by 277·274 if the dimensions are in inches, and divide the result by the product of the two given dimensions. The quotient will be the third dimension required. To find the number of gallons contained in a cylindrical cistern, multiply the square of the diameter in feet by the length of the cylinder in feet, and the product by 4·895; or multiply the square of the diameter in inches by the length in feet, and the product by ·034; or multiply the square of the diameter in inches by the length in inches, and the product by ·00284.

Clarionet

Putting New Cork on Clarionet Joints.—If a recess is left for the cork, fit on the cork

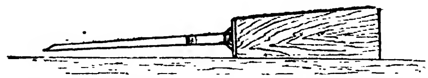


Fig. 194. Getting Chisel Handle in Alignment with Blade.

ring in two halves cut obliquely. Fix it in position with thick shellac varnish, and bind it round with thread or string till it has thoroughly set. Then trim off to size outside with wood file and glasspaper.

Cracks in Clarionet.—In the case of a serious crack, it is better to get from a metal turner a neat ring, brass or German silver, and put this on, having a recess turned out of the wood, and sinking the ring flush. To cut such a ring, get a piece of mandrel-drawn brass tube of the same external diameter as the clarionet at the crack, and cut off a strip about ⅛ in. broad in the lathe, with the tube fixed on a wooden mandrel. If the cracks are not very far gone, this might be successful. If well done, it would at least prevent their extending.

Fixing Clarionet Reeds and Pads.—Clarionets and all wood wind instruments have keypads made of kid leather or animal membrane, filled with wool, felt, or cotton wool. They can be purchased at 4d. to 6d. per dozen. The kid pads are best, and are the cheapest in the end. They should be fixed with shellac, sealing-wax, or tyre cement. Make the cement hot enough to drop a little into the key cup, then warm the key in a candle flame, and adjust the pad imme-

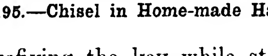


Fig. 195.—Chisel in Home-made Handle.

diately, refixing the key while still warm. The reeds should be made to suit the player and the mouthpiece of the instrument. Reeds are sold marked H for hard, S for soft, and M for medium. Choose those most suitable, remembering that hard

reeds will be more durable than soft reeds. The mouthpiece is generally the source of trouble. It should, if necessary, be relaid by an experienced player, who ought to have one of the chosen reeds in order to test it. The distance between the reed and the tip of the mouthpiece may vary from about $\frac{3}{100}$ in. and $\frac{4}{100}$ in., the reed being tangent to a curve of from $\frac{7}{8}$ in. to $\frac{15}{16}$ in. long. As mouthpieces frequently alter in form through warping, ebonite is sometimes

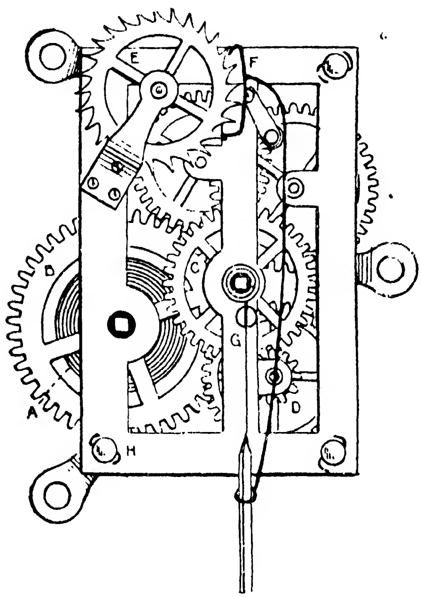


Fig. 196.—Mechanism of American Clock.

used instead of wood; but ebonite expands by warmth, so that the advantage gained is not considerable.

Clay

Newly dug clay is generally wanting in tenacity, and ware made from it is much more liable to crack than if the clay had been "weathered." Weathering, or exposure to the weather, will toughen the clay. The clay, when dug, is laid in heaps and occasionally turned over. The water and oxygen of the atmosphere and the influence of frost disintegrate, wash, and purify it, thus greatly improving its quality. Clay is also toughened by being well worked or kneaded. For modelling purposes there is nothing like old clay—that is, clay that has been repeatedly used; and consequently when a mould has been made from a clay model, the clay is thrown back into the bin, becoming tougher and more ductile by this continual usage. Clay may also be toughened as follows: Spread out a small lump of it on a board. Mix together a tablespoonful of sulphuric acid and linseed oil, and spot this here and there over the exposed surface. Roll up the clay and well work it together.

Clay Models, Casting (*see* Plaster Casting).

Clay Pipes (*see* Tobacco Pipes).

Cleaning or Cleansing

Information on cleaning a great variety of substances and articles is given under various headings in this book. The most powerful detergents are caustic potash and caustic soda, but they are too powerful to use indiscriminately, owing to the destructive action that they have on the skin. By combining them with the various fatty acids as in the manufacture of soaps, the effect on the skin is neutralised, but the detergent action is not destroyed. Ammonia is a useful cleansing agent, but should be diluted before use. Then there is carbonate of soda (washing soda), carbonate of potash (pearlash), and borax. These are all of an alkaline character. Two vegetable principles are also sometimes used—quillaia and saponin.

Clock Cleaning

The most simple kind of clock is one in which the motive power, represented by either a weight or spring, is applied to a train of four wheels and pinions, and controlled by a pendulum, no striking or alarm work of any kind being added. Of this class the ordinary American or German wood-cased timepiece is probably the most common. Fig. 196 is a sketch showing its mechanism. In order to get at the works for cleaning or any other purpose, the first thing to do is to take off the hands. Begin by drawing out the pin from the centre square with the pliers, and remove the washer beneath it, putting both in a safe place. The minute hand

can then be lifted off. Next take hold of the hour-hand socket firmly with the fingers and pull it off. It is pushed on to the centre friction-tight only, and a firm pull will bring it off. Now remove the dial, which will be found to be either tacked or screwed on at the corners. Unhook the pendulum-bob for safety, and proceed to unscrew the clock movement from the back of the case. When this is out it will be found to be much like Fig. 196. These clocks are by no means all made alike; every make differs slightly in details and arrangement of wheels, but the same parts can be traced in any make from the description of one, as their use is in all cases the same. In Fig. 196 the mainspring is found at A, the outer end being hooked on to one of the pillars of the frame, and the inner end to the "arbor" of the main wheel B. The next wheel C, carries the minute hand, and the hour hand is worked by the "motion work," D. Then come two other intermediate wheels leading to the 'scape wheel, E, and "pallets," F. Attached to the pallets is a long wire, terminating in a loop, through which hangs the pendulum-rod. This wire and loop is termed the "crutch." In proceeding to take the clock to pieces, the first thing to do is to remove the pendulum rod. With the small blade of a pocket-knife prise open the split brass stud, G (Fig. 196), and lift out the pendulum-rod, drawing it through the crutch. On no account undo the pins holding the frame together until the power of the mainspring is either held in or allowed to spend itself, or disaster will result. One way of taking the clock to pieces would be to take off the pallets, F, and let the wheels run until the power of the spring is spent, and then take the frame apart. This method is all very well as far as mere taking apart is concerned, but will in all probability give a great deal of trouble when the time comes to put all together again, on account of the spread condition of the mainspring and the difficulty of confining it sufficiently to allow the wheels to be placed in position; therefore, the way to proceed is first of all to wind the spring right up, and then clamp it by means of a mainspring clamp. Fig. 197 shows a clamp; this is sent out with new mainsprings, and serves to confine them. To apply the clamp, slip it over the wound-up spring, hold it in position while the pallets are removed, and let the clock run. The spring then expands and tightens in the clamp. The clock can then be taken apart safely, and th clamp must not be removed until the clock is again put together. If one of these clamps is not available, wind the spring up full, and pass a piece of string round it, pillar and all, and tie it up, letting the wheels run as before until the spring will unwind no further. This method, however, is not so good as the first, seeing that the spring and main wheel cannot be removed from the back-plate for purposes of cleaning. The movement is now in pieces. Before cleaning it, an examination must be made to see that all is in order,

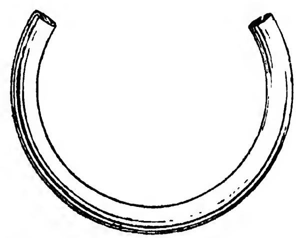


Fig. 197.—Clamp for Clock Mainspring.

Take up the main wheel and spring, and placing a key upon the winding square, try the "click-work"—that is, see if the click is sound and the ratchet teeth all right. If the click is damaged, take it off, and rivet a new one on. Clicks can be bought very cheaply. Examine all the pivots, and if any are bent, straighten them carefully with a pair of pliers. Look to the wheel teeth, especially the 'scape wheel, to see if there are any bent teeth. If there are, carefully straighten them. Take up the pallets, and see if the faces are cut by the 'scape-wheel teeth. If they are, take a fine emery-stick and flat them down level, taking care to finish off with a very fine one, and leave them in a perfectly smooth state. See if the wire crutch is firmly riveted into the pallets, and not loose; also that the pallets are firmly riveted to the brass piece which works on the pivot. Try them on their pivot, to see if the holes are worn very

wide. If they are very bad in this particular, take a small broach and open them out a little—just enough to make the holes nice and round, as they are probably worn oval more or less. Next knock out the pin which serves as a pivot in the plate, open out the hole a little, and knock in a large-sized steel needle quite tightly, the needle to be sufficiently large for the pallets to work upon it without shake. Then cut the needle off to the correct length. This will complete the examination. Now take some benzoline, and pouring some out into a bowl, place all the parts in, and with a brush wash them thoroughly free from all grease and sticky oil. They may then be dried with a duster, and laid by for a few minutes. Each wheel, when dry, is thoroughly well brushed, and the pinions cleared out with a clock-peg cut to a point. The plates are wiped dry, and all the pivot holes "pegged" out clean. Take the centre wheel and try the "set-hand work." It will be seen on examination that the centre wheel is only friction-tight upon its pinion, and on the application of a little force can be turned round upon it. Now the tendency in these cheap clocks is for this to wear loose, and cause the hands to move too easily, and they lag behind while the clock goes, causing it apparently to lose time. If this movement is found to be too easy, give the washer a knock down to tighten it. An inspection will show the manner of doing this.

Putting Clock together again.—First take the bottom plate, and on it place in position the main wheel with the mainspring upon it, clamped, and the other wheels. Then put on the top plate and 'scape wheel, pinning them on securely. See that all the wheels run freely, and if so, proceed to put on the pallets, and while doing so observe that the crutch is quite free of the top plate at its lower end, and does not drag on it. The mainspring can then be wound up and the clamp taken off. If all is free, the clock will at once start off ticking at a rapid rate. Now give attention to the action of the escapement—that is, the 'scape wheel and pallets. It will be seen, by placing a finger on the crutch and allowing the wheel teeth to pass slowly one at a time, that a tooth gives one pallet an "impulse," and then the wheel runs till another tooth falls on to the other pallet. To be correct, this distance, the "drop" of the tooth, should be very small compared to the impulse. If it is excessive, power will be wasted, and very little will reach the pendulum. If the wheel has much "drop" the depth is said to be too shallow, and to remedy it the pallets F (Fig. 196) must be brought a little nearer to the wheel. To do this, first stick a peg between the wheels to prevent them running; then remove the pallets, and with a pair of pliers turn round the arm that carries the pallet pivot: only turn it the slightest possible distance. Then replace the pallet, and try again. If too deep the teeth will not pass. It is a good rule to deepen these escapements as much as possible without making the 'scape-wheel teeth catch. Now put a little clock oil on to each pivot and a little on the pallet faces; also oil the coils of the mainspring and the pallet pivots. Then replace the pendulum-rod, nipping the brass stud tight with a pair of cutting nippers near its base. The movement can now be screwed in its case once more. Before putting on the dial and hands, put on the pendulum-bob, and stand the clock on a level shelf, or on the board if that is quite level, and see that it is "in beat." All pendulum clocks must stand "in beat." To try it, let the pendulum swing but little—only just enough to keep the clock going. Then listen and see if it ticks evenly, thus—tic—tic—tic—tic; or goes tic tic—tic tic—in twos. If the latter, it is not in beat, and the crutch must be bent with pliers until it beats quite evenly. When in beat, the dial and hands may be put on. In putting on the hands, see that the hour hand is pushed on properly, or the minute hand when pinned on will bind it and stop the clock. Also, before putting on the dial, ascertain if the pendulum-rod hangs freely in the crutch and does not stick in it, and place a very little oil at the point of contact.

Pinning on Plates.—For pinning on the plates in cheap clocks, ordinary clock pins should not be used; it is best to use special pins. To make them, procure some copper wire of a size that will pass through the

holes in the pillars quite easily. With the cutting nippers cut it up into lengths of ⅜ in. or so. To use them, pass them through the pillar as at H (Fig. 196), and with a pair of pliers turn them round as shown. These pins cannot possibly come out.

Replacing Mainspring.—To replace a broken mainspring in one of these clocks, take off the old one, and from the material shop get another of exactly the same width and put it on. See that the eye of the mainspring is fairly hooked on to its hook; then when it is in the clock, and all together, wind it up, and remove the clamp.

Replacing Pendulum-rod.—Replacing a broken or spoiled pendulum-rod is a very simple matter in these clocks. The rods are bought in long lengths, and one being selected, it is cut down to the exact length of the old one with a pair of cutting nippers, and a hook formed on the end with the aid of a pair of pliers. If the old pendulum-rod is not available as a guide, make the new one as long as the case will allow, and shorten it till correct, this being ascertained by trial.

Clock Dial, Repainting

To repaint a zinc clock dial, first all the old paint must be removed. The white ground is done with white paint in which varnish has been mixed, or with white enamel. The figures are then painted on with black enamel or varnish black. The black and white enamels sold in small tins are very suitable. Before cleaning off the old paint, trace the minutes by means of tissue or other thin paper, and when the new white ground has been laid on, mark them through with a pin point or by lining the other side of the tissue with soft lead pencil and rubbing it on the dial. Probably a new dial would be cheaper in the end.

Cloth and Clothes, Cleaning

Cleaning Gentlemen's Clothes.—Tweeds and serges should be washed in the following manner: First brush them well to remove the dust. Pare into very fine shavings some Sunlight soap and pour boiling water on it (2 gal. of water to 6 oz. of soap), and beat up into a lather. When it has cooled down, put the garments in and work them about, but do not rub them. Squeeze out as much of the dirty water as possible, and rinse thoroughly in two relays of tepid water to remove all traces of soap. Neither very hot nor cold water must be used, as they cause shrinking and hardening. Now press the water from the garments, but do not wring them by twisting. Dry them in the open air, if possible, but never near a hot fire. When nearly dry, they should be ironed. Diagonals and black cloths are best cleaned with a solution of ammonia (two tablespoonsful of the latter to a pint of tepid water) applied with a fairly hard brush; this will remove grease marks. The shine caused by wear may be taken out by lightly passing a piece of fine emery cloth over it. The ultimate appearance of cleaned garments depends considerably upon the way they are pressed or ironed.

Cleaning Motoring Garments.—Oil and grease stains can be removed from a motoring jacket by thoroughly sponging with petroleum spirit and drying with clean rags. Petrol is really a petroleum spirit, and would no doubt serve the purpose. The method of treating other stains will depend on their nature; usually stains contain grease or oil, and the above treatment may be sufficient to remove them all. However, if petrol does not remove the stains, they must be very strongly fixed, and another method must be tried. Procure a bucket of hot water, some soap, a scrubbing brush, and some clean flannel cloths. Lay the jacket on the table and brush well with the soap and water, treating small portions at a time, and dry out each portion with the flannels, damped with clean hot water, before proceeding further. In this way go over the whole of the jacket, removing the dirty soap and water as it forms, then hang up the coat to dry.

Cleaning Oily Sponge Cloths.—Oily sponge cloths can best be cleansed with petroleum spirit. For this purpose one or more galvanised iron cans with lids should be provided. Into one of these the cloths should be placed and then covered with petroleum spirit. From the first can, the cloths can be transferred to fresh petroleum spirit in a second can, and from that to a third

can, in order that all the oil may be extracted. The cloths should then be wrung out, placed in the open air to dry, and well shaken. If a proper still were provided, a lot of the petroleum spirit and the oil could be recovered from the contents of the first can when the spirit became too dirty to clean any more, and the second can would then be made the receptacle for the dirty cloths, and thus the process could be made continuous. The oil left in the still could be made clear and ready for use again by filtration. This method of cleaning oily cloths is better than boiling with soda; there

Fig. 198.—Clothes-post.

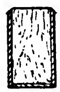


Fig. 199.—Box or Case to Fit Bottom of Clothes-post.

is less labour, and the cloths are left open and in the original condition; boiling with soda time after time makes the cloths lumpy and hard. The work would, however, have to be conducted carefully in an open shed without naked artificial lights, as the vapour of the spirit is very inflammable. If it is preferred to boil the cloths with caustic soda, the addition of a little paraffin oil to the water will quickly bring out the oil and dirt.

Cleaning Rainproof Overcoats.—A fawn-coloured rainproof overcoat may be cleaned as follows: Cut ¼ lb. of Castile soap (white) into shavings and boil with 1 qt. of water till dissolved; then remove from the fire, and when somewhat cooled, add 5 oz. of methylated spirit. Spread the overcoat over a table and brush it well with the hot soap solution. This should be applied to one portion of the coat at a time, and immediately afterwards wiped out again with clean wet cloths. After going over the whole of the coat in this way, wring out the cloths and again rub over the coat. Any very dirty portions may have a little fuller's earth rubbed on while wet. Now dry very slowly, and when nearly dry place a cloth over the collar and cuffs and iron them with a moderately hot iron; after this finish drying. If the overcoat is rubber-proofed, do not use the iron.

Cleaning Scarlet Tunics.—Use the French method of cleaning (described later) or proceed as follows: First well brush the tunic to remove the dust. Dissolve a pennyworth of salts of sorrel in half a pint of boiling water, and apply the solution with a clean clothes-brush. If possible, the garment should be hung in the sun to dry.

Dry Cleaning, or French Cleaning.—The French method of cleaning clothes is also known as the dry or chemical method. The clothes are cleaned by steeping them in spirits of turpentine; benzine, or benzoline, and benzol are also employed for the same purpose. The plant used consists of a number of closed, bucket-shaped tanks, in which the sorted articles are dipped or steeped in the liquids. A more efficient apparatus consists of a large iron cylinder capable of being revolved, and which is fed through a man-hole. The revolution of this apparatus causes the rapid cleansing of the clothes, which after the operation are turned out along with the liquid. The clothes, after treatment as above, have to be thoroughly dried by a steam heat, and then brushed or shaken to remove the loose dirt. The principle of the process is that dirt is held to clothes by grease, so that, if this grease be removed, the dirt is loosened and may be easily shaken out. The process is as effective as washing, and it does not affect the colours of clothes in the slightest; the only drawback is the effect of the solvent on the workpeople.

Removing Ink Stains from Cloth.—It is said that frequent applications of dry salt are effective when the stains are quite fresh. Most ink stains, however, are best removed by means of a saturated solution of oxalic acid.

Removing Photographic Chemical Stains from Cloth.—This all depends on the nature of the chemical causing the stains. The

agent which would satisfactorily remove one stain might intensify and render worse a stain caused by a different chemical. The stains of pyrogallic acid developer may be removed by the use of a ½ per cent. solution of potassium persulphate, washing the fabric immediately the discoloration is gone. In obstinate cases, sodium hypochlorite may be employed; this is also effective with many other stains. Hydroquinone stains may possibly be eliminated by the use of a weak ferricyanide and hypo reducer; gold stains with chlorine water; silver stains with a solution of thiocarbamide or of ammonium persulphate. It is extremely difficult (especially when of long standing) to get rid of chemical stains on fabrics without damaging the material. Boiling with sodium hypochlorite (which is made by dissolving 2 oz. of chloride of lime in 30 oz. of water, and 4 oz. of sodium carbonate in 10 oz. of water, mixing the two solutions, boiling, and filtering) is a method which may be usefully employed for white fabrics. In all cases thoroughly wash after treatment.

Cloth, Dust (*see* Dust Cloth)

Cloth, Tracing (*see* Tracing Cloth)

Clothes-posts and Clothes-lines

In fixing clothes-posts, remember that poles placed in low-lying spots where the rain-water cannot drain away are liable to rot at the ground line. A method of preserving posts is to char them to a little more than the length they will enter the ground. Avoid any depression of the soil round the post, and so prevent water accumulating and ultimately rotting the post. Give clothes-posts two coats of white-lead paint, and repaint every year. The following is a method that has given complete satisfaction: Get the pole to its proper length, and bore the hole through the top for the insertion of the line. About 3 ft. of the bottom must be kept square, with the same diameter at the set-off and bottom, as shown in Fig. 198. A box, omitting the cover, should be made to fit nicely the bottom up to the set-off, bevelling the top as in Fig. 199. Then a good coat of tar should be given to the case and bottom of the pole. Next the case should be put into the ground, leaving about 6 in. above ground; then insert the pole, as in Fig. 200, care being taken not to make the case too tight. The pole can be taken out from the case every year and given a good coat of tar, and then re-inserted without any trouble, thus preserving it for a good many years. Two coats of white-lead paint should be given to the top. Another successful method is: Get some good 3-in. square posts of proper length. From the bottom 2½ ft. cut away the corners slightly; then get some cast-iron piping, such as is used for down-pipe rain-water, or gas main work, with the moulded end. Have taken off with a cold chisel about 2½ ft. from each. Then insert the pole, leaving a

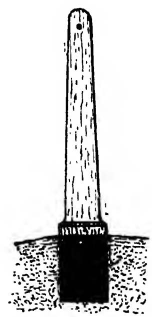


Fig. 200.—Clothes-post Fitted in Box or Case let into Ground.

hollow end of 3 in. or 4 in., which is filled up with boiled pitch and creosote oil (tar will do as well); allow this to cool and set, and then pour some down the pipe, well surrounding the pole (*see* Fig. 201). It is as well to cut a hole in the top of the post and fix a galvanised pulley in it, running on an iron pin which goes through the post. By using a wire line instead of a rope, which soon rots, fastened by a loop fixed to a hooked nail at back of post, a satisfactory job can be made of it. On the post for lowering the line put three nails, on either of which the loop can be fixed; it can then be drawn up tight and looped on the lower nail. Other devices will suggest themselves. The following, for instance, has advantages: At the top of the post fix an iron hook A (Fig. 202) with nut and washer B.

Then obtain an iron pulley c, and to it attach a ring as shown. Pass the line through the pulley and hook up with a short arm (Fig. 203). One end of the line is attached to a ring by copper wire, and is hung on a hook in the wall; fasten the other end to a cleat hook on the post. To lower or tighten the line, simply undo it at the cleat hook, and when the line is not wanted, hook down the pulley and leave it hanging to the line. Rope clothes-lines should be taken down, dried, coiled up, and stored indoors as soon as done with.

Coal Bags

Coal bags may be preserved either by tanning or by tarring. A tan liquor may

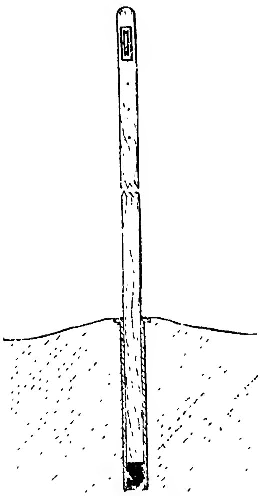


Fig. 201.—Clothes-post Fitted in Pipe let into Ground.

be made by boiling $2\frac{1}{2}$ lb. of oak bark in 4 gal. of water; keep the solution in a copper, earthenware, or wooden tank. The bags should be steeped in the solution for forty-eight hours, then removed, wrung out, and allowed to dry in the open air. Tar liquor may be prepared by dissolving $2\frac{1}{2}$ lb. of wood tar in 1 gal. of benzol; dip the bags in this solution, and dry in the open. Care should be taken that no flame or fire is brought near the benzol, because it is a very inflammable liquid.

Coal Briquettes

The hand manufacture of coal briquettes from coal slack hardly requires a detailed description, says a writer in the *Bazaar*, as the process is comparatively simple: 3 parts of fine slack or coal dust are mixed with 1 part or less of sawdust, liquid tar is added, and the whole is mixed to the consistency of mortar, or perhaps somewhat thicker. Then the mixture can be moulded by pressure into briquettes, or it can be formed into balls, afterwards being dried slowly by exposure to the air. They are improved by being kept some time before use. When yellow clay is used instead of tar, the mixing is effected by means of water, the mass being rolled into large balls by the hands, and dried in the sun or in a warm place.

Coal-tar (*see* Tar)

Cockroaches (*see* Beetles)

Cocks (*see* Plug Cocks *and also* Taps)

Coils (*see* Electric Coils)

Coins

Cleaning Coins.—Dip the coins for a few minutes in 1 part of strong nitric acid to 3 parts of water until clean; then wash them in hot water, and dry in warm sawdust.

Coin Impressions.—Sharp impressions of coins may be obtained by using a mixture of equal quantities of molten, thinly liquid sulphur and infusorial earth and a little graphite. Liquefy the mixture by heat and apply with a spoon or spatula to the coin; on cooling, an impression of great sharpness will result. The graphite prevents the impression becoming dull or unsightly.

Coins as Weights (*see* Weights).

Colophony (*see* Resin)

Colouring Flowers (*see* Flowers)

Colouring Metals (*see* Bronzing)

Colouring Wood Chemically

The following process has been patented in Germany by A. Thinom, of Berlin. The

wood is covered with solutions of metallic salts by means of a brush or otherwise; it is then left to dry for about twelve hours, then taken into an air-tight room in which gases or vapours are introduced, such as sulphuret of hydrogen, ammonia, etc., according to the tint required to be gained. Thus, a brown tint is obtained from sulphide of bismuth, formed from nitrate of bismuth. Yellow from sulphide of cadmium, formed from solutions of cadmium sulphate. Gold yellow: Bisulphide of tin, from chloride of tin solutions. Iron grey to brown: Sulphide of lead, from solutions of acetate of lead. Green: Oxide of chromium, from solutions of chromic acid. Red: Trisulphite of antimony, from antimony solutions. This process is said to be cheap, and the wood can be coloured to any design. The colours obtained are not affected by air, light, or water, and can be washed. A very cheap solution of hydroxide of iron in chloride of iron is used to impregnate the wood for floors, stair treads, and other articles exposed to much wear, afterwards colouring with ammonia. The wood in this case is less apt to burn than when painted in the ordinary way.

Condenser, Coil (*see* Electric Coils)

Copper

Copper (Cu) is a highly malleable, ductile, and tenacious red metal greatly used in many industrial arts. It does not resist the action of acids, and even moist air affects it, causing it to form green carbonate. Verdigris is copper acetate, which is used as a pigment and is, unfortunately, very poisonous. Copper is also caused to oxidise by heat; it is volatile only at a great heat. It has a specific gravity of 8·9, and melts at 2,000° F. Commercial copper contains many impurities. Copper is much used in its commercially pure state, but is greatly in demand as the chief ingredient of the important brass and bronze alloys. Copper sometimes occurs native, being then often covered with an oxide and carbonate crust; it is sometimes found in grains in sand, but is more generally obtained by the reduction of its ores, which are very plentiful.

Copper Boiler, Cleaning (*see* Boiler).

Copper Bronzing (*see* Bronzing).

Cleaning Copper.—A composition recommended for cleaning copper consists of 1 part (by weight) of 40-per-cent. hydrochloric acid, 5 parts of finely powdered Venetian tripoli, and 4 parts of water. Another mixture is 4 parts of tartaric acid, 4 parts of tripoli, and 5 parts of water. By reducing the quantity of water the composition becomes a paste. Apply the mixture by means of a cloth, afterwards rubbing the metal with a dry cloth, the copper being cleaned and polished in the one operation. To clean copper vessels, a good plan is to rub them with a cut lemon dipped in salt, afterwards rinsing with clean water and rubbing with soft cloths.

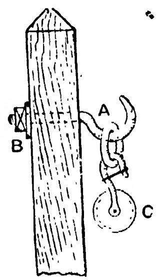


Fig. 202.—Top of Clothes-post with Pulley.

Fig. 203.—End of Short Arm.

Fixing Design on Polished Copper.—Below is described a method of fixing a design on polished copper, so that the portion not ornamented may be restored to its original colour. If the copper is lacquered, remove the lacquer and thoroughly cleanse from all grease, etc. Paint the ornamented portion over with asphaltum varnish, and leave to dry for an hour. Dip the article thus treated in (or pour over it) a mixture of equal parts of water and aquafortis, until the groundwork is sufficiently dead. Then rinse the article in water and remove the varnish with turpentine. Scour over with fine sand and water and dry in sawdust (boxwood sawdust preferably).

Hardening and Softening Copper.—The difference between hard-rolled and special soft copper is caused by the methods of

annealing. Hard-rolled copper can be rendered soft and ductile simply by placing it over a fire or stove until well heated, and then gradually allowing it to cool. Copper may be hardened by well heating and then plunging it for a moment in cold water, afterwards allowing it to steam dry. If kept submerged until cold the metal will prove exceedingly brittle. In repoussé work, soft copper will crack whenever the tool is applied too forcibly; these cracks may be soldered from the back.

"Scoured Copper."—Articles of "scoured copper" now obtainable in such great variety are so called because of the finish which they have. This kind of finish on brass is known as "old English" or "old brass" finish. The method of producing it on copper or brass is by the use of a tampico fibre wheel and a mixture of ground quartz (powdered flint) and pumice-stone. The two are mixed and used wet on the tampico fibre wheel, and the effect is to give the surface a "scratchy" appearance. Pumice-stone alone usually is not capable of scratching enough, so that a mixture with the powdered quartz is used. If the quartz is used alone the effect is usually too rough. A coat of lacquer is then applied. Ordinary commercial copper is used for this purpose. The articles in "scoured copper," which are now found on the market, often show imperfections in the shape of streaks. If care is taken in selecting the copper, this will be avoided to a considerable extent, although commercial sheet copper is difficult to obtain in a condition free from flaws. As one side of a sheet of copper is invariably better than the other, the sheet should be inspected before using and the better side exposed in the article.

Copper, Tinning (*see* Tinning).

Copper Tubes, Bending (*see* Tubes).

Welding Copper.—Prof. J. R. McCall says that the copper should be treated with potassium nitrate and a cyanide, and then, having been heated in an ordinary forge fire, it can be welded to another piece of copper, or to iron or steel, in the usual way. To ensure good results, have a clean fire of coke or charcoal, and have the temperature of the copper somewhat below white heat; if the temperature is much above, the metal will become brittle, and if much below, the flux will not be sufficiently fluid. In tension tests, the welded joints were found to be as strong as the rest of the metal. Apart from the above, it should be said that in welding copper it is of great importance that carbon should be kept from the ends to be dealt with, and the material is therefore heated by preference in a gas flame. Light blows from a wooden hammer make the joint, and, owing to the softer nature of the material, a lower heat is necessary than when welding wrought iron. A mixture of 1 part soda phosphate and 2 parts of boric acid is used. The copper is raised to a red heat, the powder applied, the bars heated to a cherry red and hammered. By another method borax is used. The ends of the bars are brought to form a lap joint, the borax placed between, and the surfaces heated and hammered. The joint is then raised to a white heat, and a compound for excluding oxygen thrown over it. Common salt may be used for this purpose. The joint is then welded up. A stream of chlorine gas is sometimes thrown on the joint whilst welding up. To prepare the borax for use, it is heated till the water of crystallisation is expelled, and then ground up to a fine powder.

Coppers, Washing (*see* Washing Copper)

Copying Appliances (*see* Autocopyist *and* Hektograph)

Coral

Bleaching and Cleaning Coral.—To bleach coral, wash it in clean water with a soft tooth-brush; then steep it for about an hour in a chloride of lime solution containing 2 oz. of chloride of lime and $\frac{1}{8}$ oz. of hydrochloric acid in 1 pt. of water; finally wash it in running water for another hour. The following method answers for large pieces of white coral that have been soiled with dust, etc.: Dissolve 4 oz. of strong hydrochloric acid in 4 pt. of water; place this in an earthenware basin, as the acid attacks metal. Dip the coral in the solution for a few seconds only; the upper layer of

the coral will be dissolved off, carrying the dirt with it, leaving the coral perfectly white. Now place it in clean water, changing the water two or three times, then remove, shake, and dry in a warm place. Another method: In a large pan full of soapsuds hang the coral in a net so that it is submerged, but does not touch either the sides or bottom of the pan, and place the pan on the fire and boil. Next take it off, throw away the water, wash the coral in clean water, replace it in the net, and put it back in the pan as before; fill up with clean water and again bring to the boil. Then take the coral out, rinse in clean water, and allow to drain.

Cutting and Polishing Coral.—Coral can be cut with a hard steel saw, such as watchmakers use for cutting metals, but it is slow work, and the saw will require frequent sharpening. It can be drilled by a hard steel drill. Pumice powder on rag or a revolving buff will polish it.

Stringing Coral.—If the perforations in the coral are sufficiently large, it will be best to string the coral on the finest steel or copper wire. If the perforations are small, use a fine silk or linen thread; these are much stronger than the ordinary cotton thread.

Cork

Cork is the outer layer of the bark of a species of evergreen oak. These trees are largely cultivated in Spain and Portugal, and are found in South Europe and also in the north of Africa. The first strippings are taken from trees of about twenty years' growth. This is the virgin cork, so often used as ornamentation on ferneries, etc. It is also useful for tanning operations. The bark is subsequently removed about every eight or ten years, its quality improving with time. The trees flourish for 150 years or more.

Artificial Cork.—Phellosene, or artificial cork, is made by grinding cork-bark to an impalpable powder, and making it into a dough with a solution of nitro-cellulose in acetone. This is moulded, compressed, and allowed to dry. The material contains from 10 to 12 per cent. of nitro-cellulose, and is claimed by its French inventor to be but very slightly more combustible than cork itself.

Bleaching Corks.—The effect of the usual bleaching agents upon corks is not what one would expect; in many cases these cause corks to become darker and not lighter in colour. Chlorine, however, will render the corks paler, but will impart to them a yellow colour, and if used in large quantity will destroy the material and render it rotten. Oil of vitriol is not suitable for bleaching purposes, since it is never entirely washed out of the corks, and, being a non-volatile and powerful acid, it blackens them when they are dry, should they be submitted to a slight heat. Try a solution of chloride of lime (bleaching powder), followed by a solution of hydrochloric acid, both slightly warm, and finally wash with water. A good white can also be obtained by dipping in hard white spirit varnish which has been ground with a little zinc white and thinned with methylated spirit.

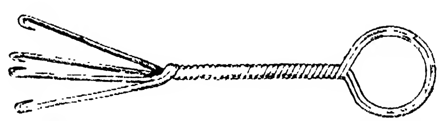


Fig. 204.—Device for Withdrawing Corks from Bottles.

Boring Corks.—If the corks are bored by hand, they are held by the left hand while the cutter (a steel tube sharpened at one end) is pressed with a rotary motion through them with the right hand. A pair of gas pliers may be used to hold them, but the less pressure employed the better, as it interferes with the passage of the cutter. For machine boring, the cutter should, if possible, descend with a spiral motion; the cork may be held in position either with the gas pliers mentioned above or by a press with jaws like those of the pliers.

Bottle Corks: How to Remove.—For removing a cork that has fallen right into a bottle a string loop is often used; insert the loop, invert the bottle, and the cork being in a likely position, pull the string. The appliance shown by Fig. 204 is made

from wire about $\frac{1}{16}$ in. thick. The hooks all point inwards. It is pushed into the bottle and the latter is turned upside down. The cork then falls between the four hooks, and, on being pulled, the hooks close when passing through the neck of the bottle and grip the cork; a good pull, and out it comes.

Cement for Cork.—Cork can be joined together with rubber cement, which can be made by dissolving pure Para rubber shavings in benzol or carbon bisulphide; about 1 part of rubber to 15 parts of either solvent. Rubber cement can be bought very cheaply, and if it is too thick for the purpose, can be diluted with a little benzol (coal-tar naphtha).

Chemical-resisting Corks.—Corks, if previously steeped in vaseline, may be used in the place of ground glass bottle-stoppers. Neither acids nor chemical fumes injure them, and they do not become fast in the neck of the bottle as do ground glass stoppers. It is doubtful whether any treatment would prevent corks being acted upon by a strong solution of caustic soda. It is usual to treat corks with melted paraffin wax, the corks being kept in the melted material for several hours. Cerasin wax is a better material, and has a higher melting-point. For resisting caustic soda, steep the corks for several hours in silicate of soda solution (1 part of silicate to 4 parts of water), and then in lime water for several hours. They can be waxed afterwards, if desired.

Ornamental Cork Work: Frames.—Corks for this purpose may be disused bottle corks of all kinds, or new corks—preferably "wine" corks—can be purchased. The cutting of cork so as to leave clean surfaces is not easy. Its elasticity naturally makes this operation rather difficult, as the cork gives way to the pressure of the knife. The blade, of course, must have a fine edge and be very sharp; remember that hacking or chopping is useless. Use the knife with a quick, firm, drawing motion—just as a razor is used when shaving—and not with a heavy, downward action, which tends to squeeze the cork, and thus causes the cut to be irregular. When cutting up the material, keep all the whitish and discoloured parts separate, and take care to store up the snippings for use when the groundwork is being finished. Picture frames are perhaps the most suitable articles to decorate with cork. The foundation, of course, is of wood (deal), and this must be rebated out. Any amateur carpenter can put these frames together, as all parts in the finished article which are not hidden by the actual pattern are easily covered in other ways. In some cases,

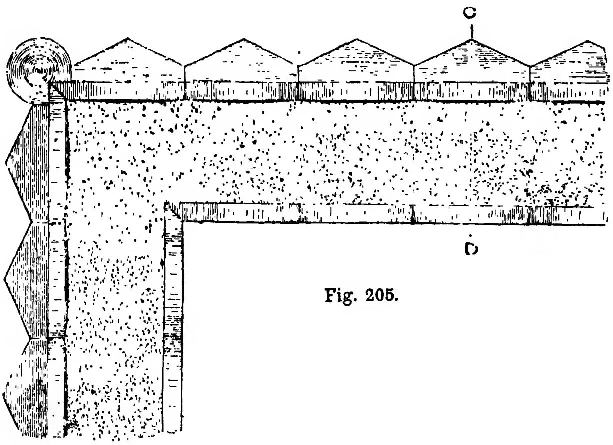


Fig. 205.

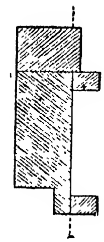


Fig. 206.

Figs. 205 and 206.—Elevation and Section (on Line C D) of Part of Simple Cork Frame.

however, when the frame has been well made, it is not necessary to cover all the foundation. In Figs. 205 and 206, and especially in Figs. 207 and 208, the pattern is made up chiefly of half-rounds. Pieces of this shape may be readily obtained by slitting an ordinary bottle cork lengthways through the middle, and then cutting it transversely into sections. Unless all the pieces are of uniform size, the artistic effect will be marred; and until one has acquired proficiency in the use of the knife, it will be found a great help to use a gauge made of sheet metal or stout cardboard. coating of glue is spread over the portions of the foundations to be covered, and the half-rounds are fitted in quickly, care being taken to keep them close and regular. Liquid glue is recommended for this work, as it is easily and rapidly applied. The space which has been left uncovered between the projecting borders must now be considered. In the accompanying designs it will be noted the ground has a rather rough appearance. This is accomplished by giving the exposed portions of the wood a thin coating of glue, and then strewing over this cork which has been

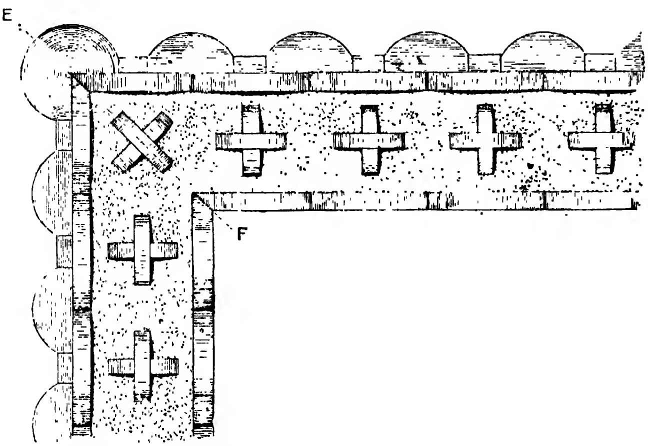


Fig. 207.

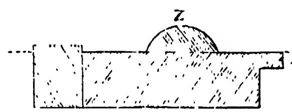


Fig. 208.

Figs. 207 and 208.—Elevation and Section (on Line E F) of Cork Frame Ornamented with Half-rounds.

Fig. 205 gives an idea of the style of work usually undertaken by beginners. It is very easily worked, and for this reason is suitable for a preliminary lesson. In Fig. 206 is given a section of the frame on the line C D, which clearly shows the positions in which the cork is placed. The half-rounds are fixed on the top and broad side of the foundation as borders, whilst cornered sections are used to cover the outer edge of the wood. These outside pieces, as shown in Fig. 206, are cut sufficiently large to reach and cover the bottom edges of the half-rounds, of which the outer projecting border is formed. When sufficient sections have been cut, they are arranged on the frame to see if they all properly fit their positions. If so, a strong powdered to a fine dust. Thus all the small snippings are used up, and a good finish is given to the frame. Or a wood-carver's grounding-punch may be used on the foundation; but the method most frequently adopted by expert workers is completely to veneer the frame with sheet-cork. By some, however, the roughened surface, as illustrated, is considered the most effective. Again, teak and cedar foundations render such a covering unnecessary, as their natural colour matches that of the cork ornaments. The frame should now resemble the corner shown at Fig. 205, and, as a finishing touch, a couple of coats of shellac varnish should be applied. Or, if preferred, the projecting borders and the outer sections may be painted

black, and the inner portions left untouched. Then, when the roughened surface begins to lose its freshness, it may again be renovated by the application of gilt. Fig. 207 is another simple design which can be easily worked. It is formed almost entirely of half-rounds, as such shaped sections can be cut with scarcely any trouble. A section of Fig. 207 on line E F is given at Fig. 208; Z in the latter figure shows how the ornaments jut out from the foundation. The projecting borders are exactly the same as those in the previous design, but the cork on the outer edge differs in that the wedge-shaped pieces are replaced by oblongs and half-rounds. Fig. 209 presents a pattern which requires a little more patience. In this case, both the inner and outer edges are covered, and this with alternate half-rounds and pointed sections. The central ornaments are formed of square-topped pyramids surrounded with triangular pieces (*see also* Fig. 210), and half-balls (*see* Fig. 211) formed by roughly cutting out pieces of cork and rubbing them on a stone. The line G H (Fig. 209) corresponds with the section Fig. 210, whilst the line I J (Fig. 209) corresponds with the section Fig. 211.

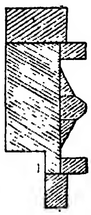


Fig. 210.

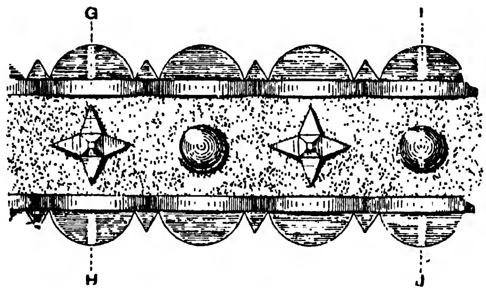


Fig. 209.

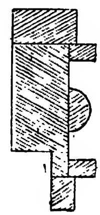
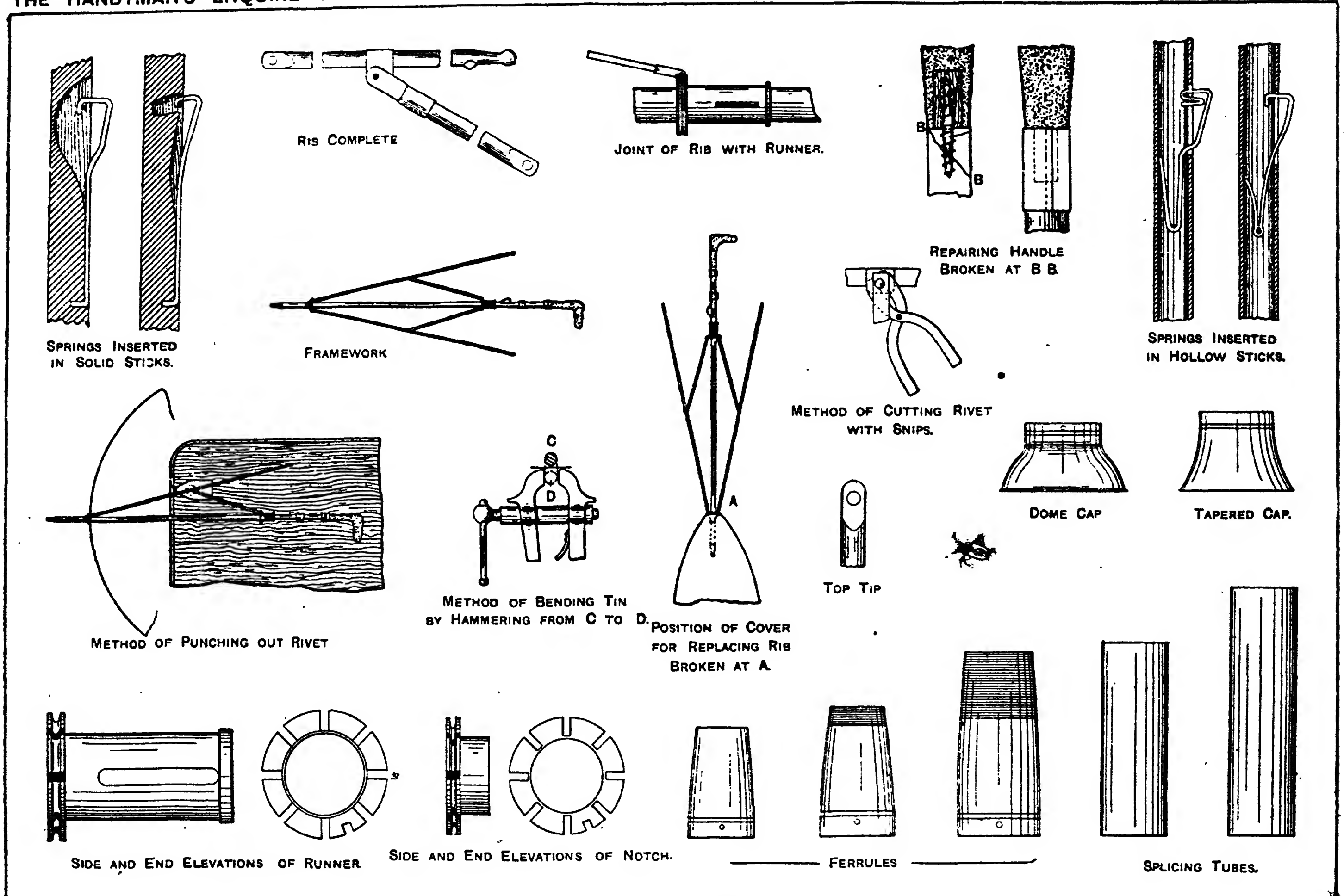


Fig. 211.

Figs. 209 to 211.—Elevation and Two Sections of Part of Cork Frame Ornamented with Stars and Half-balls.

Ornamental Cork Work: Hanging Flower Vase.—The hanging flower vase covered with half-circular pieces of cork illustrated by Fig. 212 has an effective, rustic appearance. To make it, an ordinary earthenware flower-pot A (Fig. 213) is required. The rounded bottom B is turned from a piece of soft wood such as pine or deal; if a lathe is not at hand, it may easily be carved with a chisel, or even with a knife, as the surface need not be very even so long as the general outline is somewhat correct. The block B is secured to the pot with a screw which passes through a small circular block of wood C, about ½ in. thick, and then into the block. A ring of thin wire as in Fig. 214 is carried round the upper part of the pot, and its two ends are fastened by twisting with a pair of pliers as shown at D. Three loops are then made and attached at E. The thickened top edge of the flower-pot prevents it from pulling off when suspended by chains as in Fig. 212. To make it doubly secure when it is in position, glue over it a strip of linen or canvas; also glue the remainder of the pot. The pieces of cork which cover the pot may now be put on. Corks that have been used in bottles are suitable for the purpose. They are first cut in slices, and then in half as at F (Fig. 215). Glue them round the top as shown. The next layer must be glued on as shown by the dotted lines G, so that they are laid alternately. The smallest corks should be kept for the bottom part of the wood block, as the circumference diminishes. When finished, put on two or three coats of varnish and coat the loops E with liquid gold paint. The chains, the hook and brass collar H (Fig. 212) for fastening to the ceiling may be obtained at any ironmonger's. Should there be no beam in the ceiling near the desired hanging position, carefully screw a sharp-pointed



PARTS OF AN UMBRELLA.

gimlet into a plastering lath; this will make a start for the screw-hook, and if carefully done will carry the weight of the vase and the pot containing the plant. As an alternative, to make the vase more effective, the corks may be coated with gold paint or enamel. Or if desired, the corks may be broken up in pieces about ¼ in. square, and glued on in an irregular rustic manner.

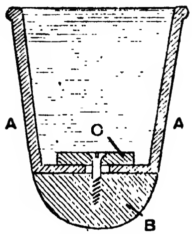
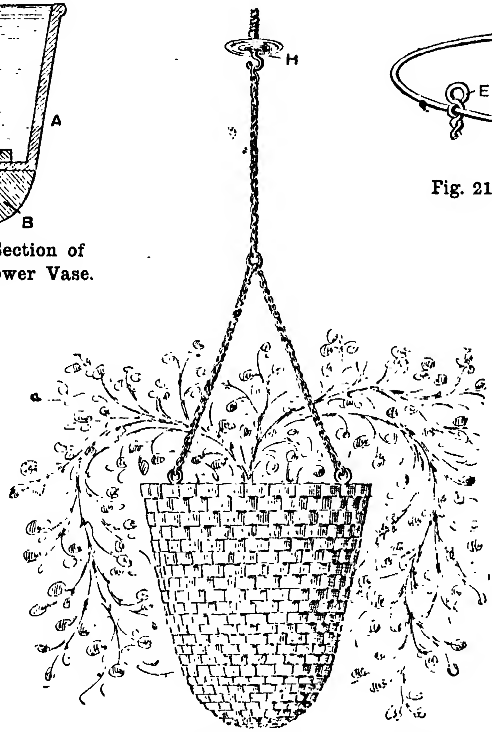


Fig. 213.—Section of Hanging Flower Vase.



Eig. 212. Hanging Flower Vase in Cork.

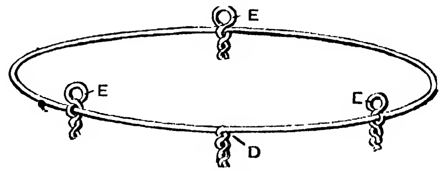


Fig. 214.—Wire Ring for Supporting Flower Vase.

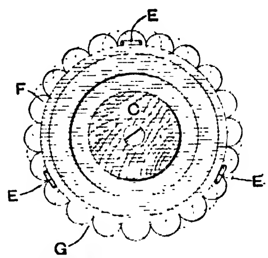


Fig. 215.—Method of Fixing Corks to Hanging Flower Vase.

Ornamental Cork Work: Photo Frames. —Fig. 216 shows a simple pattern applied to the decoration of a photo frame. An old, well-worn wooden or leather frame may be used for the foundation, or any plain piece of wood may be cut to a suitable ornamental shape by means of a fret-saw. At the head a kind of floral ornament is given, made up of a pyramid, half-rounds, points, etc., whilst in each of the four corners is seen a pyramid surrounded with sloping sections. On the sides and bottom crosses formed with half-rounds have been fixed; and, to prevent the design from having too open an appearance, there have been placed between the chief decorations small sections of corks taken from phials, etc., the projecting ends of which have been cut to a pyramidal form. The borders are merely formed of pieces of an almost oblong shape, whilst the ground is covered in exactly the same manner as a picture frame. The patterns given in previous figures can, of course, easily be adapted to these frames. Photo frames, however, can be ornamented in an even more elaborate style, for, if they have wide, flat margins, the worker can easily arrange the cork so as to represent ruined gateways and feudal castles. To reproduce a ruined Italian porch, first,

a fluted column is securely fixed to one side of the frame, and, to give it the appearance of having a badly-damaged cornice, some small pieces of cork are irregularly glued to the top. The rest of the frame is then covered with thin blocks cut to resemble stonework, and over the whole a few fine bits of moss should be allowed to trail. Next, the cork is burnt in some places with a red-hot iron wire so as to give it an aged appearance. The entrance to an

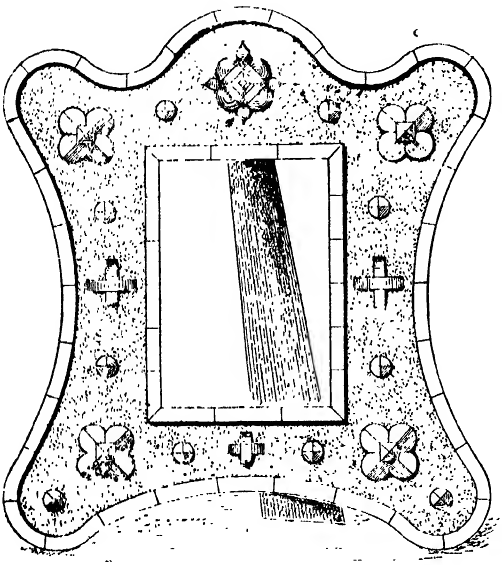


Fig. 216.—Photograph Frame Ornamented with Corks.

ancient castle is built upon somewhat similar lines. Cork blocks take the place of stones, and these cover the entire frame with the exception of the upper portion. Over the opening filled by the photograph some slightly curved pieces imitating the overhanging top of a feudal gateway are placed, those parts which are in retirement being further darkened by means of the heated wire. The battlement does not need description, for it is easily formed by covering the top of the frame with alternate sections of different heights. The effect may then be further enhanced by sprinkling the whole with very fine cork dust. In such designs as these, discoloured wire corks may be used, for by skilfully arranging stained sections a variety of pleasing tints may be obtained.

Powdering and Pulping Cork.—Passing cork between corrugated or roughened rollers will reduce it to powder; heating it in a boiler under pressure with water will reduce it to pulp. Cork powder is largely used for packing grapes imported into this country in barrels; almost any fruiterer would supply small quantities of it.

Reducing Size of Bottle Corks.—To make a large cork fit a small bottle, it is the common practice to trim the sides of the cork. Often the knife is dull, and the cut irregular. A simpler way is to cut a wedge-shaped piece out of the cork across its lower end. If the cork is very large, cut out an additional wedge at right angles to the first. This will make a perfect non-spilling stopper.

Sealing Corks in Bottles.—The simplest and cheapest method of sealing corks in bottles is as follows: Place a small hemispherical pan of cast-iron on a tripod stand and heat by a burner, the flame of which is so regulated that the wax is kept in a fluid condition without a tendency to burn. About 3 lb. or 4 lb. of wax should be kept in the pan, and when the bottles are securely corked they should be inverted, and the corks just pressed below the surface of the melted wax; sufficient of the wax will adhere to the corks for the purpose of sealing, and it will harden with a glossy, level coat. If desired, the wax may be stamped before it sets. The best result is obtained if the corks are driven in flush with the mouths of the bottles. The wax to use for the purpose is called "bottle" wax; it is cheap and easily melted.

Sterilising Corks.—Cork possesses a number of very valuable properties—great elasticity, imperviousness to liquids and gases, and great durability and low specific gravity—but its one serious defect is its porosity, which, especially in the inferior grades, is increased by the presence of cork meal, a material which results from the disintegration of the stone cells which penetrate the cork fibre, and, falling to a powder,

facilitate the entrance of infection. After micro-organisms have once gained a foothold in the pores, it is extremely difficult to dislodge them. Boiling in water impairs the quality of the cork, without completely destroying the infecting germs. The water thus imbibed by the pores is squeezed out when the cork is inserted into the bottle, and may thus give rise to an infection of the contents. Prolonged steaming of the corks does eventually kill all the germs, but also causes the corks to shrink and deprives them of their elasticity. The most effective means of sterilising corks hitherto practised consists in paraffining; this closes the pores, but does not destroy all the germs. H. Gronwald has introduced the "Supersanum" apparatus. It cleans and sterilises the corks, and then impregnates them with a special mixture. To remove the cork meal, the corks are dried, then placed into a wire basket, which is suspended in a double-walled cylinder into which steam may be injected. The cylinder may be revolved, so that the corks are freed from the meal by centrifugal force. They are then sterilised by treatment with the vapours of formol and ethyl alcohol and simultaneously steaming. In this way, it is claimed, all germs are effectually destroyed. The sterilised vapours are now displaced by germ-free air, and the melted impregnating material introduced into the cylinder. After cooling, the corks are ready for use. The cost of this method is very small.

Waxing Corks.—The paraffin wax should be melted in an enamelled or tinplate pan over a burner, and heated until the wax begins to smoke or give off vapour; the lamp should then be removed. If the corks are to be paraffined all over, they should be placed in a wire basket (the baskets that are used for preparing chip potatoes will do) and dipped into the hot wax; the baskets should then be raised and held over the pan until any excess of wax has drained away. If the lower part only of the corks is to be treated, they should be taken one at a time between the fingers and dipped in the melted wax. They may be stood bottom upward on trays in a cool place till hard.

Cornet

Cleaning Cornet.—Do not clean a brass cornet with polishing paste. It can be made brighter, and will keep clean longer, by polishing with crocus powder and sweet oil, and finishing with dry crocus and a soft cloth.

Loosening Cornet Slides.—Probably a little paraffin oil dripped into the joints will ease them, and if the instrument is cautiously warmed the effect will be increased. Let the cornet stand for a few hours. If oil is objected to, use a little vaseline.

Removing Cornet Slides.—Below is explained how to remove without injury the slides of a cornet which have not been taken out for years. Apply the flame of a blowpipe or spirit lamp along the outside of both limbs of the slide; in a short time it can be pulled off by means of a piece of string. Do not apply sufficient heat to melt the brazing of the joints. When the slides have been removed, clean them with paraffin oil and lubricate with tallow, or, better still, with a mixture of 2 parts of tallow and 1 part beeswax melted together and allowed to harden.

Corrosive Sublimate (*see* Mercuric Chloride)

Crayons

The following are recipes for preparing the paste medium for crayons: (a) Shred very finely 1 oz. of curd soap, and pour on it a pint of boiling water; allow to cool, and add sufficient spirits of wine to render it transparent. Make into a paste with china clay 1 part, prepared chalk 1 part, and colouring matter 2 parts, or as desired according to quality. (b) Take pale or white lac 1 oz. and wood naphtha 3 parts, and dissolve by frequent agitation. Mix to a paste with china clay and colouring matter. Roll into pieces of the required thickness, and place in a stove to dry. (c) Mix equal parts of finely ground pipeclay and chalk into a paste with beer, adding the desired colours. Manufacturers of crayons usually force the paste through cylinders of the required diameter; it is afterwards cut up into suitable lengths

and dried. The following is a list of dry colours that may be used for tinting the paste, all of which are permanent: For white: Zinc white, satin white, lithopone, blanche fixe, and Paris white. For

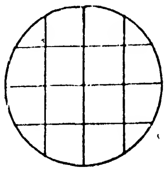


Fig. 217.—Section of Split-cane Handle of Cricket-bat.

yellows: Yellow ochre, raw sienna, cadmium yellow, and zinc chrome. For reds: Carmine, vermilion, madder red, Venetian red, burnt sienna, Indian red, light red, and red oxide. For green: Chrome greens, emerald green, and zinc greens. For blues: Ultramarine, Prussian blue, and cobalt blue. For browns: Vandyke brown, raw and burnt Turkey umbers, cappah and cassei browns. For black: Ivory black, drop black, and lampblack. A variety of tints may be obtained by mixing the above colours in variable proportions. The following instructions apply to the making of a soft olive-green chalk. Mix together 8 parts of French chalk, 2 parts of pipeclay, and 1 part of Brunswick green; then add sufficient water to make the mixture adhere into balls, but not to form a paste. Knead thoroughly and allow to stand till sufficiently dry to mould. By using a pug mill or kneading machine, the mixture can be made ready for moulding at once. The mixture can be made into crayons by placing it in a metal cylinder with tubes at one end, and forcing it through these by means of a piston. To mould it into cakes, place a ball in a brass mould of the shape required, and force it in with a die fixed in a screw press. The green can be made deeper by increasing the amount of colouring matter; it can be made more of an olive shade by using in addition a little lampblack. The crayons or cakes should be dried slowly in a warm room.

Tailors' Crayons.—Tailors' crayons are made from French chalk, either alone or mixed with a little china clay to render it harder and more coherent. Sufficient water is mixed with the chalk to make it hold together, but not to render it pasty, after which it is kneaded in a mixing machine. The mass is then pressed in iron or brass moulds. French chalk must not be confounded with ordinary chalk; the latter is carbonate of lime, and is the same as whiting; French chalk is a silicate of magnesia, and is a finely divided variety of the mineral steatite, also known as talc, soapstone, etc. (*See* Talc.)

Cricket-bat Repairing

Making and Fixing Cricket-bat Handle.—Cricket-bat handles are made from best rattan cane about the thickness of the finger. Cut the cane into lengths of 18 in. Two sides of each piece must be planed flat and four pieces glued together, and then held in a vice and strong cord tied round till the glue is dry. Either twelve pieces of thick cane or sixteen thinner pieces (*see* Fig. 217) will be required to form a handle, and after each slip of four pieces is glued up and dry, they must have the round planed off to a flat surface, and be glued up to make a square handle. When dry and taken out of the cramps, it will be ready for cutting the wedge piece to fix into the blade. If the blade is an old one already cut out to receive the handle, take a pair of dividers and measure the wide and narrow parts of the wedge, and cut the handle so that it will fit tight. Do not force it in, or it will probably split the blade. Cricket-bat handles are fixed in with an air joint, and as little glue as possible.

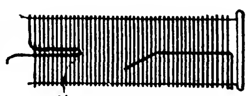


Fig. 218.

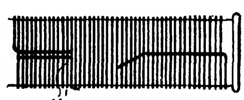


Fig. 219.

Figs. 218 and 219.—Method of Binding Cricket-bat Handle.

A wedge gauge should be made. First mark the wedge out on the blade, then with the same gauge mark on to the handle. If cut true with a saw and the rough edges pared off and out of the wedge with a

sharp chisel and the corners taken off, the handle should fit quite easily. After the handle has been put in the blade it should, when dry, be turned to the desired shape and thickness in a lathe from the top

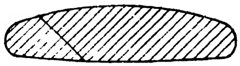


Fig. 220.—Cross Section of Repaired Cricket-bat.

down to the shoulders of the blade, leaving a knob at the top, and a channel to receive the twine. The twine should also be put on when the bat is in the lathe, starting and finishing with invisible ends (*see* Figs. 218 and 219). Without a lathe, it takes a considerable time to work down to the desired thickness and shape with a draw-knife and rasps. To bind on the twine without using a lathe, take a ball of twine, which should be waxed, make it fast to a hook, and commence at the top end by underlapping it, leaving 2 in. or 3 in. of the end out, and bind over it (*see* Fig. 218). Keep moving up towards the part that has been fastened to the hook, turning the bat over and over towards you until all the handle, except about one inch at the bottom shoulder part, is bound up; and then, before finishing, place a piece of the twine loop fashion, and bind over the loop end for about ten turns or laps; this should bring all the binding down far enough. Now cut off the end from the ball of twine, hold it firmly, and push it through the loop X. Then take hold of the loop at X, and pull the end through, and cut off flush with the binding. This will make a sure fastening. Cut the end off neat, and hammer down flat, as Fig. 219. The point X′ in this figure shows the end cut off flush.

Piece Splintered off Bat Blade.—To repair a bat that has a piece splintered off near the bottom, procure an old bat blade, saw off a piece somewhat larger than the fractured part, and plane it up true on one side. The damaged part of the bat should also be planed up true, and to the shape of Fig. 220, as it then offers more resistance than if it were joined squarely. Unite the planed surfaces with good hot glue and place on one side to dry for at least twelve hours. If the repairer has no lathe, a frame to hold the bat whilst binding should be made as follows:—Procure a piece of 1-in. floor-board about 4 ft. long and 4 in. wide, cut off two pieces 6 in. long for the ends A and B (Fig. 221), and screw or nail them to C. A hole should be bored in each end piece about 2 in. from the top, through which a long wire nail passes into the handle and the bottom of the bat. This frame can be screwed or clamped to a table or bench. When the glue is well set, the bat can be finished off, removing all surplus wood with the spokeshave, rasp, and glasspaper, and taking care to keep the bat to the proper width. One corner of the bottom should be rounded—the corner nearest the player when he is using it—and the other left nearly square. Then place the bat in the frame for binding, for which will be required some good hot glue, a ball of cabinet-maker's twine, a few pieces of white tape, and some staples made from moderate-sized pins with their heads cut off, and bent so as to grasp three strands of twine. To begin binding, glue both sides of the bat for about 1 in. wide, and stick a piece of $\frac{3}{8}$-in. tape 2 in. long on each edge of the bat as shown in Fig. 221. Place the ball of twine on the floor, and turning the bat away from you with one hand, let the twine run through the other, and wind about six turns. Then fold the other end of the tape down and bind over it as far as necessary, alternately gluing and binding about an inch at a time; it is finished off by the wire staples, one on each edge, and grasping three or four strands of binding. The whole binding should now be gone over with hot

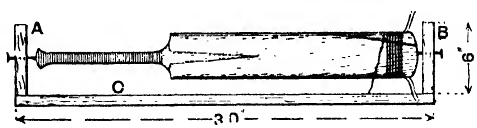


Fig. 221.—Binding Blade of Cricket-bat.

thin glue, any surplus glue being sponged off the bat with hot water.

Split Blade of Bat.—When a bat is split for some distance up the blade, but not otherwise damaged, it will be sufficient to

insert good hot glue in the crack and screw up together in a bench, or, failing that, to bind with coarse cord and tighten with wedges of wood. When dry the bat should be bound as directed above, in at least two places about 2 in. wide, one near the bottom and the other about half-way up. A bat should not be "pegged," as nothing tends to destroy the fibre so much as hard wooden pegs driven into the face of it. Should some slight cracks occur, the best way is to bind with twine.

"Sprung" Handle of Bat.—Should the handle of a bat be "sprung" and make a clicking noise when used, the pieces of cane

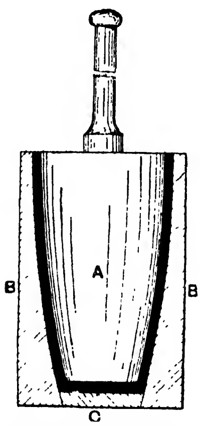


Fig. 222.—Mould for Making Crucible.

composing it have become separated, and to remedy it, unwind the binding and insert very hot glue, and re-bind. If the cane is fractured it will be necessary to wind a piece of strong canvas spirally along the handle, having first well glued the canvas and the handle. When the glue is dry, any rough places should be smoothed down with glasspaper, and an indiarubber cover glued on.

Crickets, Ridding House of

The instructions given under the heading of "Beetles" apply in this case largely. Place some insect powder,, like Keating's, in or near the holes where they emerge, and as far as possible the holes should be closed with plaster-of-Paris.

Crucibles

Small crucibles are made either on the potter's wheel or in moulds. The moulds are of cast iron or hard wood, and are made in three pieces, A, B, and C (Fig. 222). Stourbridge clay is mixed with broken crucibles, finely ground and tempered with water and kneaded for many weeks before being used. The broken crucible stuff, being already burnt, reduces the shrinkage of the clay on drying, and therefore minimises the liability to crack; the kneading renders the clay more plastic. A lump of clay is placed in the mould and the core is hammered in with a mallet; the excess of clay is then scraped off, the core is removed, and the crucible forced out by pressing the plug C. After removing C from the bottom of the crucible, a little pellet of clay is pressed in the hole formed by the core A, and the crucible is allowed to dry in a room, for several weeks. It is then placed in a cool part of the furnace and gradually moved until it has been heated to the highest degree, after which it is as gradually removed from the furnace in order to anneal it.

Curling Stones, Polishing

As a rule, curling stones are made of granite or trap, a mixture of felspar and hornblende, therefore to polish them by hand is very laborious work. Rig up a vertical lathe similar to those used by lapidaries, and place the stone on it, and, while revolving, put coarse emery and water on it, pressing a piece of smooth iron on the stone as it revolves. When all pits and unevennesses are removed, carefully wash away the emery grains and go through the same process with fine emery, removing all scratches left by the former treatment. This process must be gone through with care, as if scratches are not removed it will be impossible to get a good polish. When an even grain, dull polish is obtained, carefully wash again, removing all traces of emery. Fasten a piece of felt to a piece of wood and on it put some putty powder slightly wetted, and apply to the stone until a good polish is obtained. A good deal of the rough work might be done in bringing the stones into condition for further grinding if in the

first instance they could be slung in front of a grindstone.

Curtain Poles, Bending (*see* Tubes)

Curves

Marking Out Large Curves.—Figs. 223 to 226 illustrate a good method of striking

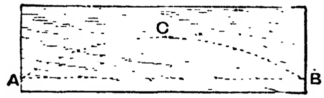


Fig. 223.—Board from which to Cut Segment.

out curved pieces of wood which are beyond the span of the compasses and trammel. Fig. 223 represents a piece of board 2 ft. by 7 in., from which it is desired to cut the segment indicated by the dotted line. Square a line over the centre of the board, and mark on that line the rise, which is 3 in.; then insert a short nail at points A, B, and C. Next prepare a thin piece of board (Fig. 224) 2 in. or 3 in. longer than the other board, and about 5 in. wide. From one end mark off half the length (1 ft.) of the straight line of the segment, and across the end of the rise, 3 in. Join these two points, and cut off the triangular piece, represented by the dotted lines in Fig. 224. This thin template is laid upon the board (Fig. 223), and a pencil held firmly at D (Fig. 224). The edge of the template is then slid along from B to C (Fig. 225), close up to the nails, when the pencil will describe the arc from B to C. The template is then reversed, and the other part of the segment described from A to C, as shown in Fig. 226.

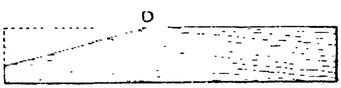


Fig. 224.—Template for Marking Curve.

Cutlery (*see also* Knives, etc.)

Testing Steel Cutlery.—In hand forged blades a dark mark will be observable just above the shoulder. The best shear steel will show the grain of the steel, notwithstanding the polish. To test the hardness or softness of the blade, pass the edge of the blade lengthways on the thumb nail; if the blade is of poor quality and soft, the edge will turn up; if it is of good steel

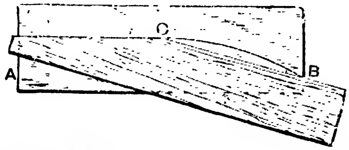


Fig. 225.—Marking One Side of Curve with Template.

and properly tempered, the edge will turn up and go back. The articles being well and truly made and finished will be another test.

Cuttlefish

The cuttlefish abounds on the British coasts. That part of it ("cuttlefish bone") that is used for forming moulds for small gold and silver castings is the bone or outer casing of the fish which, when dried, has a light and porous structure and something of the nature of lime. Thus it is well adapted for the casting of such small work as rings and similar objects. The cuttlefish bone, which is bought in pieces, is cut into two smooth slabs, and the ring or other article is placed between, and the two slabs gently brought together. The softness of the bone allows the ring to become embedded, and when the pattern is removed a hollow mould is left. Cuttlefish requires careful manipulation.

Cycle

Acetylene Cycle Lamps (*see* Acetylene).

Bowden Brake Wire.—Bowden mechanism consists of a strong steel wire working within a flexible tube which can even be

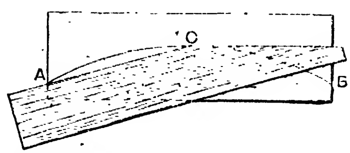


Fig. 226.—Marking Other Side of Curve with Template.

tied in a loose knot without interfering with the power-transmitting qualities of the wire. When the wire gets stretched,

it may possibly need shortening, but before undoing the joint be sure that it does actually require shortening, as much slackness may be taken up by unscrewing the small hexagon-headed pipe nut under the bridge piece or by shifting the bridge itself. To shorten the inner wire, first ascertain the exact length required to be taken off, release the two screws that hold the halves of the horseshoe piece, when the nipple and the wire will be free, hold the brass nipple in the gas until the solder melts, and then push the wire through the nipple the required distance whilst the solder is molten. Cut off the superfluous wire to within $\frac{1}{16}$ in. full of the nipple head, hammer the strands down flat, solder over the top with a soldering bit, and replace.

Brake Adjustment.—"Cycling" says that a bicycle's brake blocks should just clear the rim when the brake is "off," and the spring should take them off without difficulty; if the brake rod requires pushing down with the hand, or the lever has to be manipulated to take the brake off, it is evident that adjustment, cleaning, or oiling is required. The blocks must not be so close to the rim as to cause risk of fouling spokes or valves. If the blocks clear at some parts of the rim and touch at others the rim must be trued up, and if the brake jerks at certain parts of the wheel's revolution it shows that the wheel is not true. Worn blocks should be renewed; sometimes they can be made to do double duty by simply reversing them right and left, so that the unworn side comes into action. They must not be allowed to wear down to the metal. Wear of the brake blocks is compensated for by sliding the guides along the forks so as to bring the blocks closer to the rim, by sliding in the adjustment rod, or by doing both. When the brake of a coaster hub fails to act promptly, the mechanism will almost invariably be found to be clogged up with thick oil. Injection of paraffin, followed by free lubrication with thin axle oil, will cure this. The machine should be laid on its side during the former process, so that the paraffin shall run out without reaching the rim and tyre. Failure of the drive forward is also due to this cause.

Chain Adjustment.—"Cycling" advises that cheapness should never be a consideration in buying a chain, because a cheap one soon stretches beyond the limits of adjustment; and even if a link be then taken out its running will be very bad. A chain that is tight when felt with the hand is in constant danger of breaking under any extra strain. A naked chain tightens itself when exposed to wet, so a little slackness may be allowed in rainy weather. The connecting bolt is sometimes a cause of accident. To keep it tight, whilst at the same time allowing free play to the chain, turn it up with the screwdriver until tight, unscrew half a turn, and whilst preventing the bolt from turning by holding it with the screwdriver, tighten up the nut with a spanner. The result should be that the nut is tight and secure, whilst at the same time there is no binding of the link. There are other and better systems of connecting the chain, but the plain bolt and nut is in most general use. A frequent mistake when adjusting the chain is to throw the back wheel out of line. To avoid this, it is generally easy to hold the wheel centrally between the forks whilst tightening up the nuts. With some chain adjustments, such as the New Hudson eccentric, there is no possibility of things going wrong, but this has, perhaps, the disadvantage of being awkward to dismantle.

Chain Line.—"Chain line" in a cycle is the distance from the centre of the machine to the centre of the chain wheel. Thus, a $1\frac{1}{2}$-in. chain-line hub would measure $1\frac{1}{2}$ in. from midway between the spoke flanges to the centre of the chain wheel. A frame is measured from the centre of the bottom bracket to the centre of the large chain-wheel teeth. The chain line of hub and frame should, of course, coincide. However, it is the practice of some makers to set the machine so that a straightedge held against the outside face of the bracket wheel will be $\frac{1}{16}$ in. "off" the face of the hub wheel: the theory is that when pressure is applied to the pedals, the small amount of spring in the back part of the frame will bring the chain line correct when riding.

Chain Tight and Slack.—The reason of a cycle chain running tight in one part and

slack in another may be that the chain has worn unequally, or the chain wheels may be out of truth. Remove the chain, and spin each wheel separately, and watch the rim. If they run true, it is the chain, in which case the only remedy is to get a new chain. Whilst the chain is off, the chain wheels may be tested for alignment with a straightedge placed on the face of the large one; this should be tried in several places, and the other end of the straightedge should just miss the face of the small or hub-chain wheel.

Cleaning Cycle.—How to clean a bicycle is described in "Cycling" as follows:—(a) Remove the chain and lay it in benzoline sufficient to cover it, agitating it from time to time. (b) Sling the bicycle on brackets or by pulleys, and tie worsted or string round the three spindles (back and front hub and bracket) to keep out grit whilst cleaning. (c) Brush all tubes, afterwards rubbing with greasy cloth and polishing with selvyt; the hubs, rims, spokes, bracket-shell, chain wheels, cranks, pedals, etc., should now be cleaned outside with benzoline, having previously been well brushed with a fairly stiff-haired brush. (d) Now remove the worsted from the spindles. (e) Bearings, unless showing signs (by grinding noises) of the presence of grit, need no cleaning, but a light machinery oil should be injected into the lubricators until it runs out of the bearings freely. This, whilst cleaning the bearing to some extent, obviates the difficulty often experienced in ridding the bearings of traces of paraffin. (f) Soak the chain in lubricating oil for about half an hour, remove surface oil, and refit in position. (g) If grit is present, place the machine on its side and flood the bearings with benzoline, followed immediately by a rather heavy lubricant in ordinary quantity.

Cleaning Cycle Bearings.—The cleaning of cycle bearings is thus described in "Cycling": A bearing in any part of a cycle can be cleaned without trouble by injecting plenty of paraffin and allowing it to run out and so carry the dirt with it; this will serve all practical purposes if the cycle has not been badly used. After swilling out the bearing, plenty of thin lubricating oil must be squirted in, otherwise the bearing will suffer, for paraffin is not a lubricant. Before this treatment, rags should be tied round any part of the frame where the oil exudes, so as to prevent it running down and messing up the tyres. The parts that are most likely to need cleaning are the steering head—usually fitted with two oilers, one for the top and one for the lower bearing—the bottom bracket, and the pedals. The wheel bearings being generally frequently lubricated, and coming in for the most work, do not accumulate dirt so much, but they will be none the worse for a clean out. Paraffin applied to the pedals for cleaning purposes should not be run in at the end, so as to carry the dirt in, but should be injected at the oil hole and the machine tilted so as to run it each way outwards to the bearings; the dust-cap on the outer end of the pedals should be unscrewed to let the paraffin run out freely; after which the bearings should be well lubricated, rags being tied above the spokes below the hubs to intercept oil.

Cleaning Coaster Brake.—This is necessary, says "Cycling," if it shows signs of weakness or ceases to act. Take the hub to pieces, give it a thorough cleaning, and it will probably act as well as when it was new. When replacing the parts, take care to put the bearings in with the exposed side of the balls facing inwards, otherwise the brake will not screw in far enough.

Cleaning Free-wheel Clutch.—A clutch should be cleaned by running some petrol or benzoline through it until it runs out fairly clean; then let the petrol drain out, and lubricate with good oil. The machine should be leaned over to one side while the clutch is being cleaned, to prevent the tyres getting damaged. If the clutch runs very stiff after being cleaned and oiled, it has probably been badly fitted on the hub. When the clutch is a "ratchet" type, it will always make a certain amount of noise compared with a "friction" type. It is not necessary to take the clutch to pieces to clean it.

Cleaning Rusty Chain.—Soak the chain in paraffin for a day or two. Afterwards put round it some straw or paper and burn

off the paraffin until the chain is dry. Then brush the dirt off and boil in mutton fat. Just before the fat sets, take out the chain and wipe with a rag. The chain will not need lubricating for months, and will run very smoothly.

Cycle Running to One Side.—The defect is probably due to a fall, which has put the frame or fork out of truth. To test this and correct it, see that the front wheel is true between the forks at the rim. Then, with a straightedge placed against the side of the rim, test each side with the handle-bar stem. The straightedge should be at the same distance from the handle-bar stem on each side. Unless the tyres are quite true, they should be removed whilst trying this. If the fork is found to be out of truth, it must be removed from the head, the wheel removed, and the forks pulled over in the vice one at a time. When correct, replace and, with the machine upside down, set a long straightedge against each side of the back rim, noting whether it falls equidistant at both sides of the front rim. If this is correct, turn the machine right side up, and try the straightedge from the rear wheel rim sides to a piece of $\frac{7}{8}$-in. tube placed in the fork tube. If these are correct, the machine should "track" or run true. If "out," the frame must be pulled over or twisted accordingly. The front fork should also be tested to see that the blades are parallel with each other. To test this, place a piece of straight tube or rod through the spindle holes and a straightedge across the blades near the crown; they should be parallel with each other. Finally, see that the handle-bar is set quite square with the front wheel.

Enamelling Cycle (*see* Enamelling).

Gold-lining Cycles.—The gilding process here described will give a highly finished appearance to a cycle. By this method fine gold lines can be put on a cycle so as to retain the bright appearance of the gold. First carefully clean the cycle, using lime and a selvyt cloth to remove all traces of grease, the presence of any grease being detrimental to the success of the work. Boil a pint of water, and add to it while boiling as much isinglass as will rest on a penny. Do not increase the proportion of isinglass, or it will reduce the brightness of the gold. This is termed gilding water, for using which a camel-hair mop will be required. A piece of chamois leather stretched over a flat piece of board 8 in. by 6 in. will answer the purpose of a gilder's pad. Lay the book of gold-leaf on this pad, carefully turn open the first leaf, and cut it, as it lies in the book, into six pieces, the size of each being $3\frac{1}{4}$ in. by $\frac{1}{2}$ in. Now dip the mop in the gilding water, and pass it over the parts that are to be lined. With the gilding tip, pick up the pieces of gold-leaf separately, and lay them end to end, each piece slightly overlapping the other, on the wet surface of the work. Repeat the process with each leaf of gold until all the parts that require lining have been properly covered, when it should be left a little while to dry. When thoroughly dry, take a small pad of cotton-wool and pass it lightly over the surface; this will remove any unevenness in the gold. A small quantity of box bottom black varnish and a sword-pencil, obtainable at any oil and colour stores, will also be required. Line the cycle with the black over the gold, and leave it for two hours to dry. When dry, take a pad of cotton-wool, slightly wet it, and start cleaning off the surplus gold, taking care not to damage the lines of gold under the black. When all the visible gold has been cleaned off, the cycle should be wiped perfectly dry. Next take another pad of wool, pour on it a little turpentine, and pass the pad lightly over the lines; this will remove the black, and lay bare the gold lines. Then wipe carefully with a piece of soft rag. All that remains to be done now is to square off the corners with a piece of pointed box-wood, and to coat the gold lines with copal varnish.

Hardening Cycle Cones.—Cones are softened by heating to a dull red and cooling gradually in lime or fine ashes. To harden the cones, heat them to a cherry red and dip in water with the chill off. With some steel, the cones, when cleaned up, would now be ready for use, but with other steels they would be too hard and require tempering by letting down to a dark straw

colour. Other steels, again, would not harden at all with this process, and would require case-hardening; but the majority of steels will best be suited by the first-named process.

Hub-ring, Removing.—Well soak the ring with paraffin, and, providing there is nothing but the thread holding the ring, it will come off. It may be sweated on; try heating slightly. It may be keyed on between the ring and hub barrel, or it may be fixed with a small pin between the teeth.

Lubricants for Cycle Bearings.—"Cycling" prefers a fairly thick oil, especially for those bearings which have to carry the heaviest strain. The chief trouble, however, is to get such a lubricant into the bearing. In the case of the bracket, this difficulty is usually surmounted by unscrewing the lubricator and injecting the oil through the aperture, but this method is not possible with all the bearings. Once in the bearing, the thick oil can be depended on to stay there, and one fairly copious lubrication will usually last through a whole season. A thin oil must be applied very sparingly to prevent leakage, and consequently the operation has to be repeated at more frequent intervals. Probably few cyclists trouble to apply a different oil to each bearing, though it is obvious that the work done by, and the strain imposed on, the various bearings differs considerably. The slow and comparatively slight movement of the head, for instance, has nothing in common with the rapid revolving of the front hub; and, while a light oil will do well enough for the former, a thick, heavy grease is more suitable for the latter. The bracket and rear hub, which are subjected to the severe driving strain, also require an oil of high viscosity, such as Price's heavy axle oil. When a thick oil is used, the bearings will not appear to run quite so freely when the wheel is raised and spun in the air; but, of course, when running under their normal driving load, there is not the slightest retarding force in the heavy lubricant.

Lubricant for Cycle Chains.—The stick lubricant sold for this purpose is probably graphite or best blacklead and tallow. Melt the tallow (Russian tallow for preference), and thoroughly stir in the powdered graphite until the mixture is of the desired consistency, when it should be poured into moulds to set. Pieces of steel cycle tube, cut to the desired length, may be used as moulds; the mixture should afterwards be pushed out, when set, with a stick the size of the inside diameter of the tube. This, whilst making an excellent lubricant for the outside of the chain, is not of much use for the interior, unless the chain is immersed in the mixture whilst hot, when it will find its way into all parts, and form one of the very best chain lubricants obtainable. (*See also* Cleaning Chain, above.) Another good lubricant consists of plumbago and vaseline. Any good make of blacklead will do, but specially prepared plumbago is better. Crush the blacklead to a fine powder and mix thoroughly with twice the bulk of good vaseline and a little lubricating oil. As all these lubricants are very "dry," they must be applied about every fifty or hundred miles.

Lubricating New Departure Hub.—Ordinary oil simply runs out of the hub, owing to the heating of the brake. To overcome this difficulty a proper lubricant must be used. This is a non-fluid oil melting at 356° F., made expressly for lubricating these hubs; it can be bought of most cycle dealers. To lubricate, take down the hub, remove the brake clutch from the brake, and pack the interior of the brake with lubricant, applying a little to all bearings of the hub. Then fit together again, and if this is properly done, the hub will not give trouble for twelve months' ordinary running.

Pedal Bearing Rusted Up.—A rusted-up cycle pedal bearing should be avoided by removing the pedal and filling the inner bearing with vaseline, says "Cycling." The outer end of the pedal does not matter. Water will run down the crank and work its way into the bearing unless this precaution is adopted.

Tread of Cycle.—By "tread" is meant the overall width of the bottom bracket axle.

Winter Use of Bicycle.—"Cycling" says that the simplest way of keeping a machine in good condition during the winter is to let

appearances look after themselves and have the bicycle well covered with vaseline, and not to disturb this with a cleaning rag. Until the accumulation of mud in the guards becomes serious enough to impede the running of the machine, it is allowed to remain, and thus the protecting coating is never rubbed off. The bicycle will come out in the spring with an unimpaired gloss. Plated spokes should be avoided, as they will rust after the first shower encountered on the road. It is quite impossible to keep them clean, even with the most unremitting attention, and the only plan is to enamel them black, using glasspaper to remove the rust. Plated rims are troublesome enough, and invariably rust round the edges, but the majority of manufacturers now provide against this by enamelling them from the beaded part to the tyre. When cleaning becomes an imperative necessity it is advisable to remove the mud with a wet cloth, to avoid scratching the enamel. Tyres should be wiped down in the same way and dried afterwards. If Roman or other aluminium rims are fitted, it will be sufficient to wipe them round with a wet rag, polishing afterwards in the usual way. The back of the fork crown should be well greased, as this is a vital part which should on no account be allowed to rust.

Cycle Tyre Repairing

Fitting Rubber Bands to Cycle Tyres.

The fitting of extra rubber bands to cycle tyres is often attempted by amateurs, though seldom with success. The chief points to consider are the quality of the rubber solution used, getting the surface of the tyre and the band perfectly clean, and allowing sufficient time for the solution to set properly. Failures may mostly be attributed to too great haste in fixing on. The bands mostly in use are Smith's, and these give every satisfaction. The rubber is compressed during manufacture, and if the band is not stretched in putting on, it will be a great preventative to puncture, as the rubber closes up again when punctured, owing to this compression. There are two kinds of bands made, the endless—that is, a band which has its ends jointed during manufacture—and the plain strip, which has to be joined on the tyre. The former is best when on, as there is no fear of the joint coming undone; but it is much more difficult to fix accurately, so that the latter should be selected. The bands vary in width from $1\frac{1}{4}$ in. upwards. The $1\frac{1}{4}$-in. width is suitable for a $1\frac{3}{8}$-in. or $1\frac{1}{2}$-in. tyre, but for a 2-in. tyre use a $1\frac{1}{2}$-in. band. Use good solution; that sold by the Dunlop Tyre Co. in $\frac{1}{2}$-lb. and 1-lb. tins at 1s. and 2s. respectively is as good as can be got; only $\frac{1}{2}$ lb. will be required for a pair of tyres. It will be much handier to remove the wheels from the machine to prepare the tyres. Whilst the wheels are out, it would be as well to remove the covers and inspect the insides for any defects in the fabric caused by wet getting through any cuts in the rubber. Clean such bad places with benzoline, well solution, and fix a piece of prepared fabric or canvas considerably larger than the bad part. If necessary, fix a piece right across the whole width of the cover. This will prevent the cover bulging when blown up hard. When these patches have set, replace the tyres on the rims, blow up hard to riding pressure, and prepare the surface to receive the band. With a stiff brush remove all traces of mud or dust, and rough the surface with a file, for the width of the band, all the way round. With a rag soaked in benzoline wipe the surface well to remove any dirt. Try the band on the tyre to see if it is the proper length, without stretching, and then cut it off about 1 in. longer than what just goes round. Cut the ends square and on the slant, as at A and B (Fig. 227), so that the joint will be as shown. Now prepare the surface of the band. Place it flat on a table, under side up, and well roughen it with a file to remove as much of the sulphur as possible, thoroughly wiping over with benzoline. Much depends on how the band is cleaned. Give the band and the tyre a good coat of solution, rubbing it well in with the fingers, special care being taken to get the solution well on the edges of the band. Let this coat of solution set for at least an hour—two hours will be better. Then give the tyre and band another coat. When putting on the second coat, rub it on lighter

than for the first, so as not to disturb the first coat from the surface. Put aside to dry for the same length of time as for the first coat, when the parts will be ready to fix. If a wheel-truing stand is available, it will be well to put the wheel in this whilst putting on the solution, or the wheels may be put back in their place in the machine, which could stand upside down on the saddle and handle-bars. When the solution is sufficiently set, roll the band up, starting at the end marked B (Fig. 227). Then, standing well over the centre of the tyre, begin to put on the band by unrolling it, as shown in Fig. 228. Take care to keep it central on the tyre, and not to stretch it; in fact, it must be remembered that there is 1 in. of slack to take up, or compress, in the length. Unroll about 3 in. or 4 in. at a time on to the tyre, and at first press down the centre only, afterwards working outwards from the centre to the edges to avoid air bubbles. When within 1 ft. or so of the end of the band, see whether the edges will come properly together, and, if necessary, compress as required. When only 3 in. or 4 in. remain to finish off, neatly join the edges, which should have been solutioned with the rest of the band, before pressing down. If there is too much to compress into the remaining 3 in. or 4 in. without puckering, a piece must be evenly cut off to enable a good joint to be made, which must again be solutioned. Let this solutioned edge stand for a time to set before pressing down. Now work round the band, pressing down from the centre, and finishing off at the edges. If the worker has not a sufficiently straight eye to put the band on without some guide, two blue pencil marks may be run round, one on each side of the tyre.

Lining Outer Cover.—An ordinary Dunlop type of outer cover consists of three elements, namely, the wires, the canvas, and the outside rubber or rubber tread. To put a new lining in a damaged cover, it is generally not advisable to remove any of the old parts except to clip off with a pair of scissors any ragged places. Thoroughly brush and scrape off any mud, etc., on the old cover. The materials required to re-line are a length of prepared canvas and about ½ lb. or rather less of rubber solution. In ordering, state the diameter of the rim which the tyre fits and also its width; these measurements should correspond with what is stamped (often in violet ink) on the inner tube. Make sure that the canvas is long enough; it should be about 90 in. long for a 28-in. tyre; and about 84 in. for a 26-in. tyre. Its width should be slightly more than that of the cover to be lined. To apply the canvas lining, take the wheel and spindle out of the forks, and, if possible, fasten the spindle between the jaws of a bench vice, in such a manner that the wheel can be spun round freely in the same

Fig. 227.—Cycle Tyre Band Cut for Joining.

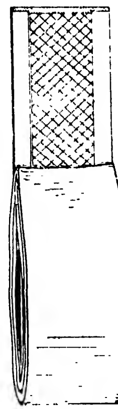


Fig. 228.—Rubber Band ready for Placing on Cycle Tyre.

position as when being ridden. If preferred, the wheel can be left in the forks and the whole machine turned upside down, resting with its saddle and handle-bars on the floor. Deflate the inner tube and shift both wired edges of the cover over the rim on one side, thus taking the cover off the rim. Next pass one wired edge through the other so as to turn the cover inside out, when the side that is to receive the lining will be outwards or upwards. Put the wired edge near the wheel rim first into the wheel trough, and then over the other side of the rim. The cover will thus be astride the rim, one wire being on each side and both wires outside the rim. Now pump up the air-tube, which will have been left on the rim in the usual place; but do not pump

more than enough to form a soft cushion, about an eighth of the usual number of pump strokes being enough. The air-tube will distend the cover and offer its surface in a convenient manner for solutioning. See that the wheel turns freely without touching any part of the frame; if it will not do so, the vice or some suitable substitute must be used to hold the spindle. Take the lid off the tin of solution, stir the contents thoroughly with a small stick, and place it handy for use. Perhaps the solution is best applied with a finger, dipping the end into the solution and smearing so as to spread it very thinly over every part of the canvas of the old tyre, and rubbing it in well. By the time the cover has been once completely solutioned, the starting part will probably be dry enough to receive

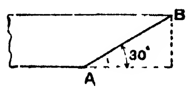


Fig. 229.—End of Lining of Cycle Tyre Outer Cover.

a second coating. If not, it must be left till it is tacky. Then apply the second coat in a similar way to the first. Next see whether the prepared canvas will stick when brought into contact, solution to solution. It should do so with great tenacity, so do not make contact with more than a small corner. The preparation on the new canvas should be tacky; but, if not, it should be given a coating of solution. Having made sure that the new lining will stick fast to the solutioned surface, cut an end, as at A B (Fig. 229), and begin by bringing the new lining and the old tyre lining into permanent contact. There can be no sliding or shifting after they are together, so that the laying on must be done most accurately. Have the end of the new lining at the soundest part of the old, and so avoid getting two weak places together. Turn the wheel round as the work proceeds, arranging for first contact along a line running midway between the cover edges. When in contact all round, go round the wheel again, smoothing out any small wrinkles and getting perfect contact from edge to edge. Then with scissors cut off the surplus new canvas, slanting the second end to fit the first with 1 in. overlapping. Next cut off any surplus canvas from the edges, and give the interior a sprinkling and rubbing with French chalk to prevent the possibility of the new lining sticking to the inner tube when replaced on the wheel. Deflate the inner tube, reverse the processes so as to turn the cover right side out again, and get the wired edges inside the rim-trough once more. Then fully re-inflate, and let the tyre stand for a day to get into condition again. The machine can then be ridden. It is sometimes advisable to deflate and examine the inner tube next day, when the solution is fresh, to make sure it does not stick to the cover anywhere. Do not keep the lid off the solution tin any longer than is really necessary, as the naphtha quickly evaporates and leaves the residue thicker than it should be to spread properly. Also the solutioning should be done where there is no gas or other flame alight, as the naphtha fumes are highly inflammable. Therefore do the work in daylight.

Re-making Outer Cover.—To put an entirely new lining to an outer cover, the outer rubber should first be removed carefully. Take the wheel out of the forks, turn up the edges of the cover where the rubber joins the canvas, and with a small bristly brush, such as a gum brush, apply a little benzine or naphtha to the place where the two parts join. Keep the rubber stretched as the brush is applied, and on contact of the liquid, separation will immediately take place. Repeat the application of liquid till the rubber is all removed. Then rip the old canvas off the wires and give these a clean up with some paraffin to remove rust. If badly eaten with rust, the wires will not be worth a new canvas and outer cover. The canvas for a renewal such as this may be bought as an endless fabric or as a strip requiring to be overlapped at the ends to form a join. The endless fabric is better. Carefully measure the width between the wires, as shown by the stripped-off old canvas, and with a soft lead pencil draw lines along the dry side

of the fabric or strip, leaving an even margin on each side. If strip is used, cut it off, say 90 in. long for a 28-in. wheel, or 84 in. long for a 26-in. wheel. New wires are to be got at 8d. a pair. Having clearly marked the canvas, fold one edge over to the middle, bringing the solutioned surfaces together with one of the wires lying snug at the line of the fold. The pencil line marked on the dry side of the canvas will guide the operator in getting the wire parallel with, and lying close under the crease. Again, the sticking surfaces must be laid together in the right position at first. When one wire is snug, add the other in the same way on the other side to follow the other pencilled line. Smooth down both turn-over edges, which should meet in the middle between the wires, or may overlap if the tyre is less than 4½ in. wide. When there is an overlap, the dry outer surface of the under lap must be solutioned to receive the already prepared inner surface of the upper lap. If the old outer rubber is to be replaced, the same procedure is followed as if a new one is to be put on, and the following instructions will apply to each case. New outer rubbers are sold by weight, and one with plenty of wear in it will weigh 14 oz. The widths vary, but should be just sufficient to extend from wire to wire across the canvas already prepared as described above. Place the wired canvas round the wheel rim with the wired edges outside the rim-trough and one wired edge over each side. Partly inflate the inner tube, which should be left lying in the rim-trough under the canvas. The canvas can then be rubbed over evenly with solution, and, when one coat has been put on, carefully rub all over the inner surface of the rubber outer cover with fine glasspaper, so as to remove the oxidised surface, to which the solution will not stick properly. Then apply a coat of solution to the glasspapered surface and let it get fairly dry. A very convenient way of applying the solution is to use a thick board or the leaf of a folding table to stretch the rubber band, the board being screwed firmly to a table or bench. Any looseness can be counteracted by hanging a suitable weight to a thick bent wire passed over the slack part under the table or board, as shown in Fig. 230. Then the solutioning can be done without risk of the rubber band sticking together in places as the operation proceeds. When the solution is well rubbed in, a fresh part can be brought on top by drawing it along, and will then go under the board out of the way in safety. When the band has been done once, put a second coat on the canvas as before; then put a second coat on the rubber band. All these coats should be continuous and as thin as they can be spread. When the second coat is fixed, the rubber band can be put in place on the canvas, which is assumed to be ready on the wheel, this being held by its spindle in a bench-vice. With an assistant, put the band on the

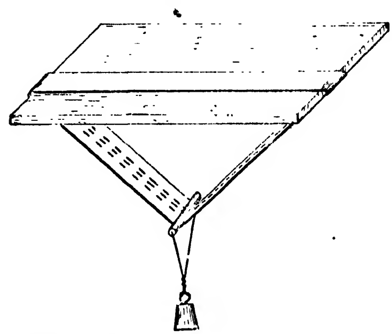


Fig. 230.—Cycle Tyre Outer Cover Hanging from Table.

canvas, each person taking two stiff pieces of wire such as meat skewers and removing the band from the board by these four wires. While doing so, turn the solutioned side inwards, and, if held one in each hand by two persons, the four wires will distend the rubber roughly in a square shape. It can be put over the circular canvas on the wheel, and by careful handling the whole piece may be got central and even all round (Fig. 231) If any irregularities occur, get one wire under the rubber band (*see* Fig. 160), and hold the ends on each side, whilst an assistant puts matters right by pulling and stretching. In this way a blistered job can be got quite level. When satisfactory, smooth carefully to the edges and apply French chalk to all parts, especially to the edges and the under side of the canvas lining, to prevent sticking to the inner tube.

Let all remain twenty-four hours or so; then rub down again, put the wired edges inside the rim-trough, and fully inflate the inner tube, when the job will be completed. Another way of putting on the new outer rubber is first to get the endless fabric, with wires inserted, quite ready. Then put these on the rim of the wheel just as if they formed a complete cover, inflate the inner tube fairly tight, apply solution, and put on the outer rubber. The edges of this have afterwards to be tucked very carefully between the wired edges and the wheel rim, the inner tube being deflated to allow of it being done, and then again inflated to make all secure. A row of stitches, preferably done with a sewing

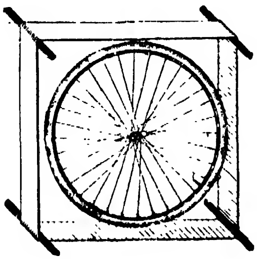


Fig. 231.—Outer Cover held over Cycle Wheel.

machine, will strengthen the cover if put round parallel to each wire and as near as possible to them. To give extra strength to new outer rubbers, it is often found to be a good plan to put the old rubber on again before the new one. The old rubber should be carefully cleaned free from grit, etc., and cut to an even width only sufficient to reach to within ¼ in. of the wired edges on each side, or the extra thickness will lead to difficulty in getting the cover on and off the rim. Both surfaces of the old rubber will need solution, and in this way a substitute for a Smith's band underneath is obtained.

Repairing Punctured Inner Tubes.—The necessary outfit consists of thin sheet indiarubber, rubber solution (which is a solution of indiarubber in naphtha), fine glasspaper, and powdered French chalk. As double-tube and single-tube pneumatic tyres are similar in principle, the same instructions as to repairing will apply to both kinds, the difference between the various patterns being the methods of detaching from the rim. First examine the defective tyre, and if a thorn, tack, or anything similar is found sticking out of the cover, pull it out and mark the spot carefully. When the cause of the escape of air cannot be traced to this source, examine the valve, and see that the valve tube properly covers the orifice in the stem. If this tube is found to be split, or is not long enough, it should be renewed, care being taken that it is drawn up over the small cone on the valve stem. If, after this has been done, leakage still occurs, the tyre must be detached and the inner tube tested. Take off the valve by unscrewing the nuts on the inner side

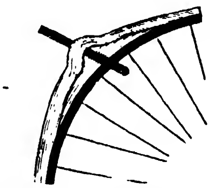


Fig. 232.—Method of Removing Irregularities in Cycle Tyre.

of the rim; then the outer case must either be taken off or loosened sufficiently to allow the inner tube to be drawn out. Readjust the valve on the tube, and inflate the tube slightly. If the leakage is large, the source will be quickly discovered; but if only slight, it may not be so apparent. Dip the inflated tyre into water, a little at a time, and the position of the puncture will be evident when bubbles of air are seen to issue from the tube. With a piece of glasspaper remove the white substance from round the puncture, then cut a piece of the sheet rubber just large enough to lap beyond the edges of the orifice; clean this with glasspaper, chamfer the edges a little, and rub the solution over the surface and the chamfered edges. Coat the inner tube with the solution over about the same area as the patch, and let the two remain fully exposed to the air for about ten minutes; then place the patch over the hole and press it well down.

After allowing time for the uniting of the surfaces, powder a little French chalk round about the place, and the tube will be ready for re-insertion. If the tyre has burst, and a piece of the outer case has been blown out, a new piece must be let in and recanvassed on the inside of the case.

Repairing Solid Tyres.— For repairing cut solid tyres there is nothing better than the best and purest rubber dissolved in bisulphide of carbon, chloroform, oil of turpentine, or naphtha; or pure rubber may be cut up fine and dissolved in benzine or other rubber solvent. Clean the cut parts, and smear them with the solution; keep them open for an hour or so, after which they may be pressed close, and the tyre will be ready for use.

D

Damp-proofing Walls (*see* Walls)

Deodorising Tablets

THE best deodorising tablets are made from thymol, but this is expensive. The common kind are made with naphthalene. Naphthalene is obtained from coal tar, and when purified it is a white crystalline material with a tarry odour. It is simply melted by heat and poured into tinplate moulds. The fancy moulds used for biscuits are very suitable for this purpose. Naphthalene is not a disinfectant, and acts only by disguising the odour with its own strong smell.

Dextrine (*see* Gum)

Dial, Clock (*see* Clock)

Diamonds

Black Diamonds.—Black diamonds, known as borts and carbonados, are exploited industrially only at the Cape of Good Hope and in the Province of Bahia, Brazil, according to an article in the "Jeweller and Metalworker." The carbonado of Brazil is a variety of black diamond with irregular crystallisation and acute angles, having a structure sometimes granular, though, unlike the bort, it does not present any cleavage. It is as hard as the diamond, but its density and porosity are inferior; it has a resinous lustre, a grey or black colour, and is opaque. The bort found chiefly in South Africa is somewhat spherical, and is not so irregular as the carbonado. It has an oily lustre, is of a grey or black colour, and is translucent. It is found in rounded masses with an exterior of a radiated or confused crystalline structure. The Brazilian carbonados have been known for a long time, but only within the last ten years have they come into use; their chief applications are in drilling very hard substances.

Diamond Setting (*see* Jewellery).

Testing Diamonds.—The most likely imitations of a diamond are "paste" (flint glass) or white sapphire. Paste diamonds can be easily filed; but a white sapphire can only be detected by an expert. A genuine diamond has a fire and play of light that it is well-nigh impossible to imitate. To distinguish genuine diamonds from imitations, several methods, in addition to subjecting the stone to the action of arc lamp rays, are available. Cover the stone with a little borax paste, heat it in the flame of a spirit lamp, and then throw it in a glass of water. If the stone is an imitation it will break into a thousand pieces, while the true diamond will remain intact. On a diamond which has been well cleaned and carefully dried let fall one drop of water, and touch this drop of water with the point of a needle; if the stone is false the water will spread or disperse, while with the real stone the drop of water will retain its spherical form. Throw a suspected stone into a glass of water; a diamond is perfectly distinct, whereas the imitation mingles with the hue of the water in such a way as to be almost invisible. Hydrofluoric acid has no action on a real diamond, but dissolves imitations. The test of making an ink dot on paper, and looking at it through a magnifying glass with the stone held between, is also a good one.

Disinfectants and Disinfection

According to the "Plumber and Decorator," the ordinary methods of disinfecting rooms suspected of harbouring disease germs are quite useless. The general result of experiments with chemical agents, says the writer, has shown the comparative or entire inertness as germicides of most of the substances commonly received as disinfectants, such as carbolic and sulphuric acids, chloride of zinc, etc. Whilst not objecting to the use of these substances, he protests against placing reliance on them. Disinfectants lose even what little virtue they possess if much diluted, and one disinfectant will often neutralise the effect of another; for example, carbolic acid decomposes Condy's fluid and renders it valueless. Rooms that have been disinfected for twenty-four hours with sulphurous acid gas have been found, when opened, to have on their ceilings flies in a perfectly lively condition. Bearing in mind that the gas is very heavy, the generating plant has been set up high in the room on a kind of staging close to the ceiling; even then flies have been found alive afterwards, whilst the householder, lulled into a false security, has promptly replaced children in the room, confident that the disease germs have been stamped out. Fresh air, sunlight, and cleanliness are better than disinfectants.

Disinfectant Shells.—The common so-called disinfectant shells are made from the material naphthalene, which is known as albo-carbon. This is not a disinfectant; it merely masks other smells by the strength of its own. (*See also* Deodorising Tablets.)

Fluid Disinfectants.—Some fluid disinfectants are made by dissolving soft soap in crude carbolic acid or coal-tar oil. Crude acid or oil (1 gal.) should be heated gently in a pan and 1 lb. to 2 lb. of soft soap should be added; the mixture should be stirred until the soap is properly dissolved, and then allowed to cool. Liquid disinfectants for domestic use are really deodorising antiseptics. Copperas is cheap and efficient, but produces rust stains and discolorations. The various salts of alumina, especially the sulphate, are good, but are more costly. A saturated solution of scrap zinc or zinc oxide in muriatic acid is perhaps the best disinfectant, but it is poisonous. To make a household disinfectant, dissolve 8 oz. of iron sulphate in 24 oz. of water, and mix with a solution of 1 drachm of corrosive sublimate in 4 oz. of alcohol. Add 1 oz. of ammonium chloride and sufficient water to make the weight of the whole equal to 2 lb. Mix this with an equal quantity of water, and the solution is ready for use. An equally good disinfectant may be made by dissolving 10 oz. of alum in ½ gal. of boiling water, and adding 10 oz. of sal soda, which causes aluminium hydrate to be precipitated. Add muriatic acid to dissolve this precipitate, thus forming aluminium chloride. Dissolve 2 oz. of sal-ammoniac, 2 oz. of common salt, and 1 oz. of chloride of zinc in ½ gal. of water, and add to the former solution. This disinfectant is said to be odourless, non-poisonous, and non-injurious when applied to fabrics.

Dominoes, Blackening

For bone dominoes, black japan should be first warmed over a fire to render it fluid, and then applied by means of a hog-hair fitch brush or German domed camel-hair brush. If used in a warm atmosphere free from dust, the japan will dry with a hard uniform brilliant finish. It should be applied sparingly. For cheap wooden dominoes, a black ebony stain and varnish combined will be most suitable. Dissolve 6 oz. of orange shellac in 1 pt. of methylated spirit, adding sufficient aniline black to obtain the desired colour. Apply with a sable-hair brush.

Draught Board, Re-covering

An old board can be re-covered with leather, and the squares painted on. Procure a piece of white skiver of the proper size, remove the old cover, paste the skiver, place it on the board and dry it under pressure. Then procure one pennyworth of green copperas and make a solution. Mark off the board carefully into squares, and paint the alternate squares with the copperas solution, using a camel-hair pencil. The copperas will stain the leather black. Spots or marks made by the copperas cannot be removed, so that the work must be

done carefully. Varnish with shellac varnish.

Door Knobs

Door Knobs.—The usual method of fixing door knobs is a very poor contrivance. A screw, necessarily short, is inserted through the neck of the knob, to get what grip it may on the spindle, or bar, which passes through the lock. The consequence of fixing handles in this way is that they are constantly coming off. A more secure way is that in which the spindle is grooved, and the angles threaded in a spiral direction. The inside of the handle is threaded in a screw form, and thus screws on to and retains a firm hold on the spindle: when it is in the required position, a screw is inserted in the neck of the knob, and screwed down into the deep groove on the spindle; this holds the handles firmly in their proper position. Latches to street-doors ought always to have a plate or curtain over the keyhole to keep out the dirt.

Drawing Paper, etc.

White Ground for Drawing Boards.—Below is explained how to obtain a white ground on drawing boards so that drawings made with charcoal and coloured chalks will easily rub out afterwards. Rub dry white-lead to a stiff paste with gum arabic melted in water; then add water till it works easily, like paint. When applying it, either stipple it with a hog-hair brush or cross and re-cross it till no brush marks are seen. A little of the white should first be tried on the corner of the board. Let it dry, then rub the fingers over it. If it rubs off on the fingers, add more gum. If it shines, there is too much gum. To melt the gum, saturate it with water and stand in a warm place.

Mounting Drawing Paper.—When a water-colour or crayon drawing of any importance is taken in hand, the paper should be mounted and stretched on a drawing-board or a frame, as hand-made paper is never sufficiently level, except for mere sketches, to use without this preparation. For stretching the paper on a drawing board, some glue, a clean sponge, and a bowl of water will be required. Put a sheet of clean, common paper on the drawing board, then hold the drawing paper up to the light and note the water mark. If this reads the right way, the side towards you will be the working side of the paper. Turn the drawing paper back upwards on the board and damp it with the wet sponge, until, when one of the corners is lifted up, it will fall back limply. The wet paper will swell, and it should be left for a little time until it commences to shrink again, when it should be turned over, the edges turned up about ½ in. against a straightedge, and then glued to the board all round. If the edges are glued while the paper is still swelling a crease at one of the corners will be the result. The paper must be put in a horizontal position, if possible, for several hours to dry thoroughly. Drawing paper mounted on linen may be stretched in a similar manner, but it will be necessary to secure the edges with tacks or drawing pins, spaced about 3 in. apart. Frames similar to those on which the canvas is fixed for oil painting are very useful for water-colour and crayon drawings. The frames may be of 2-in. by ¾-in. deal, halved or wedged at the corners, and should first be covered with stout calico tacked to the edges. The paper can be damped and mounted on them as described above, the edges being turned over and secured with tacks. When used for a water-colour drawing the paper may be allowed to remain permanently on the calico frame, which will save any further mounting by the picture framer.

Removing Stains from Drawing Paper.—If there is no writing on the paper, the best method of removing the stains will be by using a solution made as follows: Thoroughly mix together 2 oz. of chloride of lime and 20 oz. of water; also dissolve 3 oz. of washing soda in 20 oz. of water. Mix the two solutions, shake thoroughly, and filter through paper. The drawing paper to be treated should be floated in water in a flat-bottomed dish until thoroughly wetted; a little of the bleaching solution should then be added, and if, after half an hour, the stains are not gone, add more solution. When the paper is bleached, place the dish under a tap and allow the water to run for

at least half an hour, then dip the paper for a few minutes in a solution of sulphite of soda to destroy any bleaching liquid still remaining, and again wash for at least an hour.

Setting Drawing Pen.—By taking out the screw of the ruling pen and looking directly at the point of the pen, it will be seen whether the worn point has a flattened surface. If so, place the pen on an oilstone (fine Turkey preferred) in the position shown in Fig. 233, apply a little oil, and move the pen backwards and forwards, at the same time slightly rocking it horizontally and vertically. Wipe and examine the pen occasionally, and stop just short of bringing the point to a sharp edge. If one point of the pen has been injured and is shorter than the other, hold the pen upright on the stone and grind both points level before removing the screw and setting the pen. If the points are too sharp, the pen will cut the paper, and it will be necessary to take off the keen edge by using it for a few minutes on a piece of brown paper.

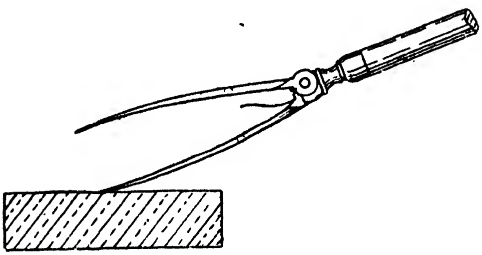


Fig. 233.—Setting Drawing Pen on Oilstone.

Thick Lines, Drawing Pen for.—A drawing pen for thick lines, say up to ¼ in. wide, can be made, says the "American Machinist," by gripping a bit of close-texture sponge in an ordinary drawing-pen, and cutting the sponge to shape and square across the end and sides. Such a pen will hold enough ink to draw a line several feet in length, and it will never make "blobs."

Drilling (*see* Earthenware, Glass, etc.)

Dust Cloths

Dust cloths—the ordinary cloths for wiping off dust—have the disadvantage of not absorbing or taking up the dust on furniture, floors, etc. They only whirl it up, and in time the flying dust falls back into its old place. In order to avoid this, the dust can be removed with damp cloths, but these may possibly damage polished articles, etc. The impregnating liquid for dust cloths described below obviates all these drawbacks, since the cloths thus treated take up all dust entirely, and they can be used for months without requiring cleaning. The liquid is produced by mixing 30 parts of paraffin with 10 parts of double-refined rapeseed oil, heating this moderately, and stirring into it 1 part of melted benzoin (gum benjamin). In this liquid the cloths are immersed so as to become entirely saturated with it; they are then taken out, wrung out well, and dried in a shady place. The cloths do not injure even polished furniture, but rather enhance the brilliancy.

E

Earthenware

Bronzing Earthenware (*see* main heading, *Bronzing Earthenware*).

Cement for Earthenware.—(1) Canada balsam forms a very efficient cement for earthenware; it will stand a considerable amount of strain, and is not affected by water. The Canada balsam sold by chemists is the crude resin obtained from the Canadian pine, and is in the form of a sticky syrup. Place some of this in a tin and heat it in the oven until all the volatile matter has been driven off and the residue becomes hard on cooling. Break the resin into small pieces and place it in a wide-mouth bottle; add sufficient benzol to just cover the resin, and keep in a warm place. When the cement is required, put the bottle in a pan of water and gradually warm it. Apply the cement (using a glass rod) to the surfaces to be united, warm them, and bind together until the cement is quite hard. The excess of cement should be pared off with a sharp knife. (2) Powder a little quicklime (not slaked lime), rub it up with white of egg, and apply as quickly as possible. This cement sets very hard, and is not affected by spirits of wine.

Cementing Broken Earthenware Worm.—In dealing with the case of a broken earthenware worm for condensing water a rigid and water-tight joint can be made by covering the broken ends of the worm with a layer of Portland cement made into the form of a ball. To prevent the action of the water on the Portland cement, treat it on the outside with a coat of silicate of soda diluted with twice its weight of water. A simple and efficient joint can be made by drawing a piece of rubber tube over the broken ends; this joint, not being rigid, allows of the expansion and contraction of the earthenware tube, and thus reduces the tendency to break again.

Cementing Earthenware to Metal.—Any of the following might be tried. (1) Mix together a pint of milk and a pint of vinegar. After a time remove the curds, and mix these to a thick paste with sifted quicklime; it is then ready for use. (2) Mix alum and plaster-of-Paris in hot water to form a thick paste. (3) Boil together 3 parts of resin, 1 part of caustic soda, and 5 parts of water. This will make a soapy liquid. Add half its weight of plaster-of-Paris. (4) Mix sifted quicklime to a paste with blood (obtained from a butcher). This must be used at once, as it hardens quickly. (5) White-lead, red-lead and boiled linseed oil mixed to a thick paste. This, however, dries slowly, and may be a week or two before it is hard. (6) Sulphur will make an excellent cement. Melt the sulphur, which should be perfectly dry, in an iron ladle, and apply in the same way as lead.

Drilling Holes in Earthenware.—A steel drill is obtained, ground at its cutting end into a pyramid with a triangular base. This may be made from a triangular file, which should be softened, filed up to shape, and tempered. This drill should run rapidly, and the cutting edges should be lubricated with a solution of camphor in turpentine. The following describes the operation of drilling a hole 1 in. in diameter in a "stone" bottle. This will be a long and tedious piece of work. Use a very hard drill of any ordinary kind, or a short piece of brass tube filled with lead and fed with emery and turps. A carpenter's brace will do to turn the

drill, although a lathe will save time. If a lathe is used, centre the drill truly to avoid breaking it or the jar. Make a circle of small holes round the outline of the 1-in. hole, letting them run one into the other. Finish the ragged edges off with a grinding plug of lead fed with emery. Or a hone-stone may be got hard enough to grind the bottle-ware. If so, it will only be necessary to mount a 1-in. disc of it on a wood button, and hold this with a two-prong solder a $\frac{1}{8}$-in. tube 6 in. long in the $\frac{1}{8}$-in. hole, leaving the 6 in. projecting at an angle of about 20° or 30° with the main limb, and pointing away from the tap. Fit a cork in the open end of the $\frac{1}{8}$-in. tube. Put a cork on the syphon so that it shall fit the bottle loosely, to let air in to replace the liquid as it is drawn off. Shut off the tap, take out the $\frac{1}{8}$-in. cork, and suck the air out of the syphon till the liquid comes. Turn on the tap and put in the $\frac{1}{8}$-in. cork.

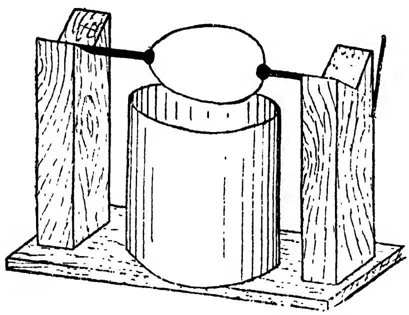


Fig. 234.—Supporting Eggshell for Waxing.

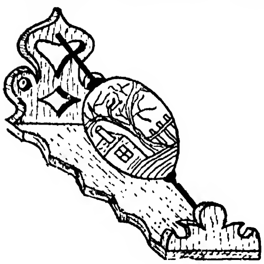


Fig. 235.—Slanting Stand for Revolving Egg.

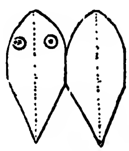


Fig. 237.—Head of Snake.

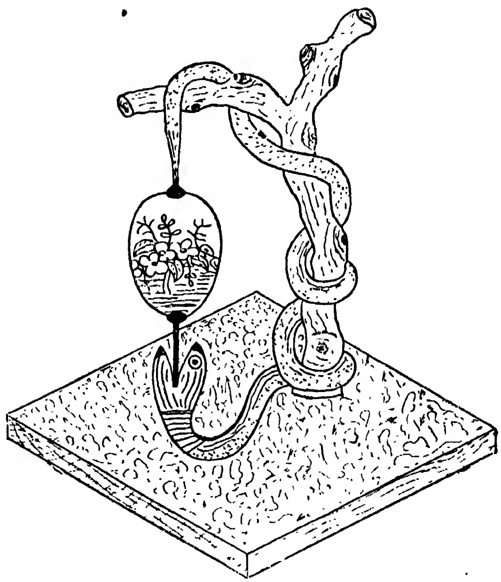


Fig. 236.—Snake Holding Egg.

bit in the brace. If only a means of emptying a bottle by a tap is required, this can be done with a syphon whilst the bottle stands on its bottom in the ordinary way. Take a piece of tubing—$\frac{1}{2}$ in. diameter is suggested. It should be tinned inside to prevent poisoning; such tinned tube can be bought at any metal warehouse. Bend it to U shape so that one limb is 6 in. longer than the other, and so that the shorter limb, when inserted at the mouth, reaches to the bottom of the bottle. At the end of the longer limb solder a tap. Make a $\frac{1}{8}$-in. hole 2 in. from where the tap is inserted, and The tap can thenceforth be operated in the usual way till the bottle is empty. By sucking at the tap itself, the $\frac{1}{8}$-in. tube and hole can be dispensed with; but this is a much more inconvenient method and is not recommended.

Earwigs, Ridding Room of

Use something that insects have an antipathy for. Sprinkle some Keating's insect powder about the room, particularly near the window where they enter, and put a bunch of wormwood or a piece of camphor under the clothes.

Ebonite

This is practically identical with vulcanite, but is black, whereas vulcanite can be of almost any colour. It is india-rubber mixed with excess of sulphur and vulcanised for a long time. (*See* Vulcanite.)

Eggshell Ornamentation

File a small hole at each end of an egg and blow out the contents; then cover the openings with sealing-wax and fasten

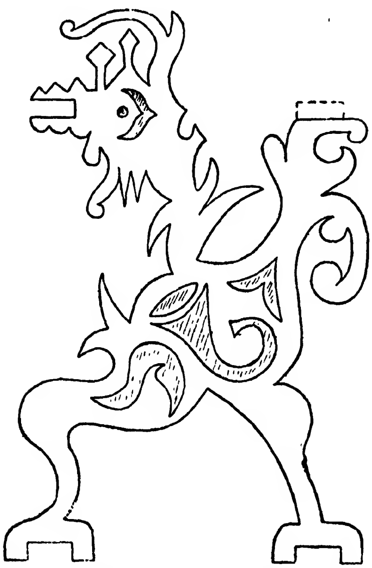


Fig. 238.—Side of Double Stand for Two Eggs.

on two matches as spindles (see Fig. 234). Make a support having a bottom piece 7 in. by 2 in. by $\frac{1}{4}$ in., and two uprights with notched tops, each $4\frac{1}{2}$ in. by 1 in. by $\frac{3}{4}$ in., placed 5 in. apart. Melt white wax in a convenient jar, which must be placed on the stand between the uprights and under the egg, resting by the spindles on the notched pillars (see Fig. 234). Brush wax evenly over the egg, turning it round without fingering the shell. When dry, draw the required picture with a hard lead pencil, penetrating through the wax in order to expose the shell where lines are drawn. Next soak it in strong vinegar for twelve hours, putting something weighty over the jar to keep the egg under the liquid; the vessel should be narrow to prevent the egg floating horizontally. Go over the design with a needle, scratching away the corroded portions; then brush black writing ink plentifully over the egg, let it dry, and remove the wax with hot water very carefully, for the shell is liable to burst during this performance. The ink has soaked into the etched lines, and the picture shows up well on the uncoloured shell. A thin coating of mastic varnish improves the appearance.

Mounts.—Decorated eggshells are seen to greater advantage when suitably mounted, so a few ideas for mounts are given. Fig. 235 is made of $\frac{3}{16}$-in. fretwood, the bottom being $4\frac{1}{2}$ in. by 2 in., the top end $2\frac{1}{2}$ in. by 2 in., and the lower 2 in. by 1 in. Cut any desired patterns, but leave the middle of the bottom piece quite plain, because the shell looks best against a smooth, varnished background. Bore a hole half through the lower end and wholly through the upper, about $\frac{1}{2}$ in. from the top in both cases, insert the spindles, and the egg will revolve freely. The same idea can be utilised in this way: Make the bottom piece $4\frac{1}{2}$ in. by $4\frac{1}{2}$ in., and the uprights the same height as before, but only $\frac{1}{2}$ in. wide; varnish some short oak twigs, varying in length from 2 in. to 5 in., and lay them crossways in the form of a basket, leaving a hollow centre; then squeeze moss into the crevices and press into the shape of a nest, hiding the uprights entirely. Strong glue should be used for fastening down the twigs, otherwise an accident may happen when forcing in the moss. Insert the spindles as in Fig. 235, and the egg will seem to recline in a nest, yet can be turned round and round. Fig. 236 well repays the extra trouble involved. The bottom is 6 in. by 6 in. by $\frac{1}{2}$ in., the tree trunk $8\frac{1}{2}$ in. long, the branch being 2 in. from the top, and stretching out $3\frac{1}{2}$ in. If a suitable branch cannot be obtained, cut the upright from $\frac{3}{4}$-in. stuff, making it as rough and natural as possible. The serpent is simply 2 ft. of $\frac{3}{8}$-in. wired gas tubing fitted with head and tail. Inside each end of the tubing glue a wooden plug 1 in. long, boring a hole partly through each

for holding the spindles. Fig. 237 shows how to make the head: Bend the sections down the dotted lines, fold one over the other, and glue the edges together. Fix it to the tubing and bind thin string around to make

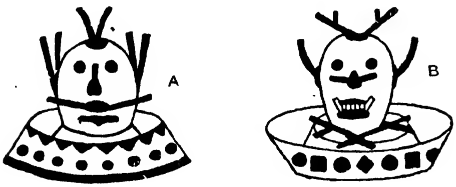


Fig. 239.—Eggshell Trinket-holders.

the neck thicker. The head should not project more than 1 in. beyond the tubing, as it would then interfere with the movements of the egg. Put a screw through the tubing 3 in. from the head, and fix it down 2 in. from the tree; draw the head up by twisting a piece of string round the snake's throat and the screwhead previous to fastening it down. Make a tapering tail 2 in. long, and glue it on the other end of the tube. The head and tail may be made of thick paper, thin card, or leather. Wind the tubing round the trunk, bring it over the branch, put in a small screw to hold it in position, insert the spindles on the shell into the mouth and through the tail, letting them rest in the wooden plugs already mentioned; paint the serpent grotesquely and strew moss and twigs upon the stand. A support for two eggs can be made thus: Cut two sides like Fig. 238 from $\frac{3}{16}$-in. wood; each should be 6 in. by 4 in.; put them 3 in. or 4 in. apart, and place short strips under the feet, in the mouth, and on the tail. Bore holes in their centres, top and bottom, and introduce the spindles. Should any mishap occur while etching, the spoilt shell may still be variously used. Being very buoyant, it will make a capital boat if corks are attached to the sides with sealing wax, and a strip of lead is put underneath to steady it. Rig up a small mast and sail, and a moderate breeze will take it along splendidly.

Toilet Table Requisites.—Something more useful is shown by A and B (Fig. 239), which represent toilet-table requisites for holding jewellery, pins, etc. Fig. 240 shows how to cut the cardboard foundation. The small semicircle has a radius of $1\frac{1}{2}$ in., the second $2\frac{1}{2}$ in., the third $3\frac{1}{2}$ in., and the fourth $4\frac{1}{2}$ in. Cut out the large semicircle, remove the shaded small half-circle, score the dotted semicircle on the underside and the smaller one on the top side. Twist the ends round, overlapping as far as the dotted line, and glue them firmly together. The cardboard will bend at the scored lines in reverse directions, forming a circular tray, which can be used either side up, as illustrated by Fig. 239. Fix the shell into the small opening with sealing wax, as in A (Fig. 239), or turn the tray over, and glue twigs crossways to make a support, as B (Fig. 239). Attach slips of wood or wire for horns, ears, nose, moustaches, and fangs, whereon trinkets may be suspended, and ornament the tray to give a satisfactory finish.

Half Shells, Broken Shells, etc.—Half shells need not be thrown away; etch the outsides, strengthen the shell with two or three coats of enamel applied inside, and make a stand as shown in Fig. 241. The wooden base is 6 in. by 3 in. by $\frac{1}{4}$ in.; the forked twigs are $2\frac{1}{2}$ in. apart, and long enough to hinder the shell from touching the wood. It is handy for holding pins, and a rough fence of twigs will support small articles of jewellery. Broken shells can also be mounted on painted corks, cinders, wooden chips, etc., according to inclination, but one precaution is necessary: Do not leave them in the vinegar too long while etching

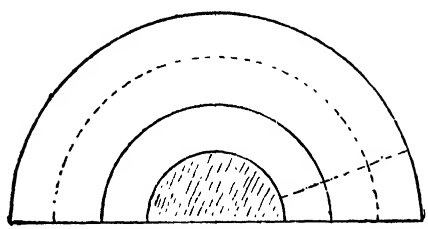


Fig. 240.—Cutting Cardboard Circular Tray.

because both sides are being acted upon, and the shell will probably collapse if steeped longer than six or seven hours. Other designs for this kind of work will readily suggest themselves to the ingenious.

Receptacles for Sweets, Trinkets, etc.—In making the fancy articles about to be described, turkeys' eggs should be used because they are strong. To remove the speckles from the eggs, soak them in vinegar

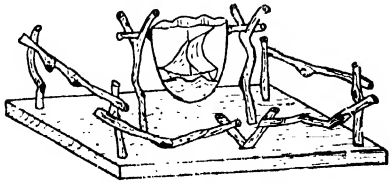


Fig. 241.—Trinket Holder.

for about thirty minutes, and wipe dry. The various holes and slits may be made by coating the eggs with melted wax, which must be scraped away where holes are required, and then soaking in vinegar for forty-eight hours. The exposed portions of the shells will be eaten away, and the under-skins can be easily cut in order that the contents may be discharged. Wash off the remaining wax with hot water, and rinse the shells out with water containing a few drops of clove oil. The eggs shown by Figs. 242 to 247 are intended to hold sweets, trinkets, etc. Make rather a large hole of any shape in the egg, and fix the edge of a scrap of stiff paper on one side. Fasten a varnish, to preserve it. Spread a few drops of clove oil over a small print, let it soak well in, and transfer to the shell. Figs. 243 and 244 show a different method of closing the hole. Shape sealing-wax to a point on the small end, embed a piece of match in the sealing-wax on each side, fix on a hat peak, and add eyes, nose, etc. (*see* Fig. 243). On the back (Fig. 244) put a movable shutter, working on the side spindles. In Fig. 245 the opening is placed near the thick end of the egg. Eye sockets, mouth, and teeth are marked before soaking in the vinegar. For eyes, set beads in rims of sealing-wax, and make thick lips of the same. Hinge a tuft of hair to the top of the shell, forming a lid over the hole. Fig. 246 shows the manner of cutting an egg to open as Fig. 247. Use strips of linen as hinges, and secure when closed (Fig. 246) by narrow ribbon.

Holder for Tape Measure.—To make a holder for a tape measure (Fig. 248), cut a hole at each end of an egg, take a square piece from one side, and make a 1-in. slit on the left. Do not scrape all the wax from the square piece; simply scratch along the lines, and the piece will come away entire. Hinge it on, and use ribbon fasteners. Cut a wooden spindle, wind a tape measure round the middle, insert it through the door, let

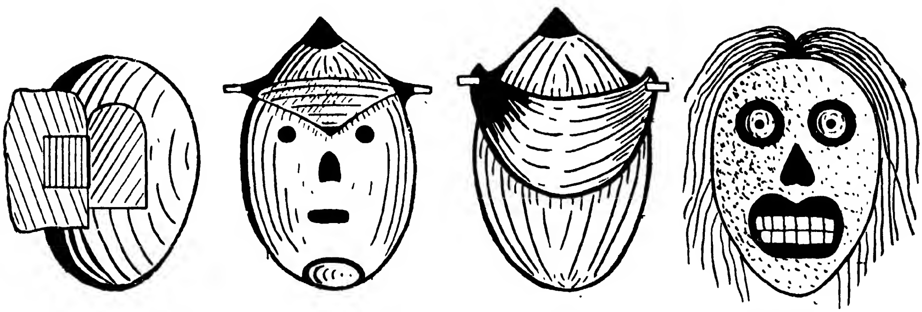


Fig. 242. **Fig. 243.** **Fig. 244.** **Fig. 245.**

Figs. 242 to 245.—Eggshell Holders for Sweets, etc.

piece of elastic inside the shell, stretch, and fix it on the back of the paper, which will then close over the hole (*see* Fig. 242). Sealing-wax is the quickest fixative for this purpose. Give the shell two coats of mastic

the ends project through the end holes, and cap them with sealing-wax. Bring the end of the measure out through the slit, and prevent its disappearance by sewing on a small ring. A circular hole might also be

made on the opposite side, to prevent the egg from rolling off the table when in use.

Inkstand.—Fig. 249 shows an inkstand. Cut the shell in halves ; fill the lower half with plaster-of-Paris, put a small bottle in the centre (if previously oiled, it can be removed

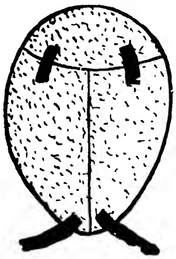


Fig. 246.

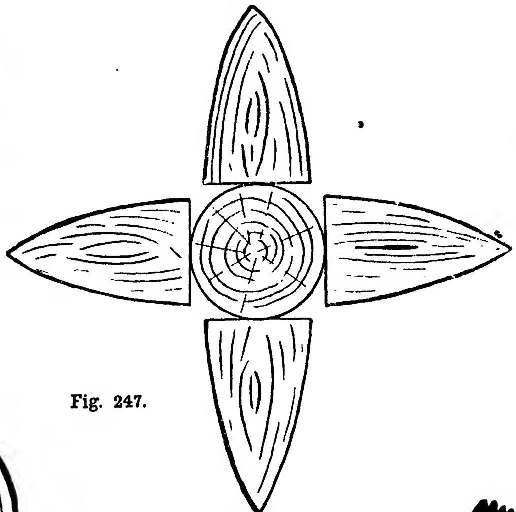


Fig. 247.

Figs. 246 and 247.—Eggshell Holders for Sweets.

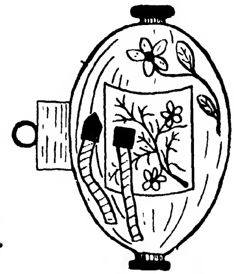


Fig. 248.—Eggshell Holder for Tape Measure.

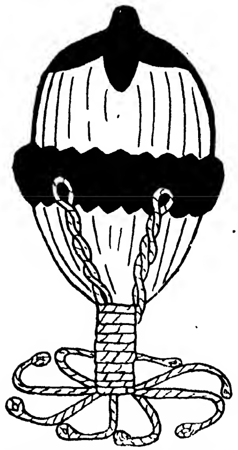


Fig. 249.—Eggshell Inkstand.

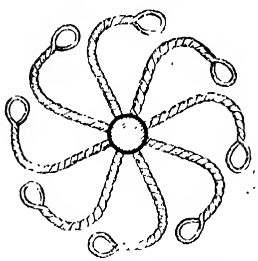


Fig. 250.—Foot of Inkstand.

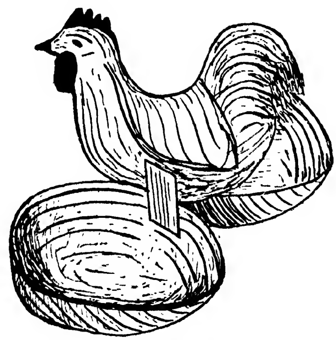


Fig. 251.—Eggshell Pin-tray.

at will), and make an outside ridge of sealing-wax, letting the top fit exactly into it. Drop the wax on carelessly all round, dip in hot water, and coax the edging into the desired shape. Put an ornament on the top shell, gild all the sealing-wax, and enamel the remainder, also the inside of the cover. Bind string round two yards of wire, twist the wire into a four-toed claw, make a 1-in. leg, and finish with an eight-spoked circle, bending the ends as shown in Fig. 250.

Cruet.—A pepper-and-salt cruet is made thus: Fashion the salt-cellar as the ink-bottle holder, omitting the plaster filling. For the pepper-box, make a hole in the small end large enough to take a small cork, which should be surrounded by sealing-wax ; also make a quantity of holes at the large end, and wash the inside thoroughly. Construct a suitable wire stand of any pattern.

Pin-tray.—Cut a suitable egg in halves lengthways, put slips of card inside adjacent edges, and fasten a cardboard hen between them, forming a pin-tray (Fig. 251), which can be closed and fastened with narrow ribbon as Fig. 252.

Pin-cushion Ornament.—A pin-cushion ornament is shown by Fig. 253. Take a

large piece from the shell, fill with bran, and cover with suitable material, putting on a narrow border of sealing-wax. Fix two shafts, 3 in. long, on the sides of the shell, make two cork chicks with wire feet, fasten one between the shafts, and perch

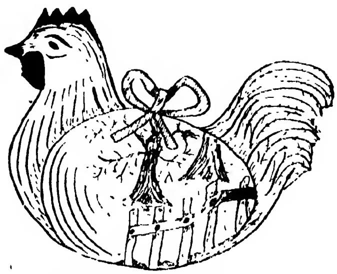


Fig. 252.—Eggshell Pin-tray Closed.

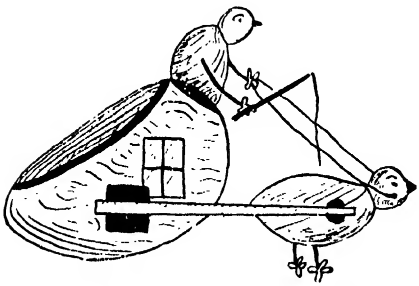


Fig. 253.—Eggshell Pin-cushion Ornament.

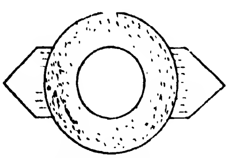


Fig. 254.—Plan of Date Indicator.

the other on the shell as a driver, then finish as fancy directs.

Date Indicator.—To make a handy date indicator, cut a circular piece from the large end of an egg, and make a slit at each side of it for slips of card on which are printed the days of the week (*see* Fig. 254). Also make holes on each side of the egg, with the necessary slits for holding the cardboard slips, which bear the month and date, and put a small handle at the lower end, so that the finished indicator can be conveniently turned. One side is shown in Fig. 255. Alter the slips as occasion requires.

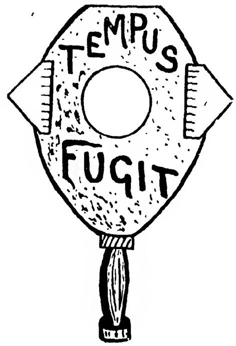


Fig. 255.—Date Indicator.

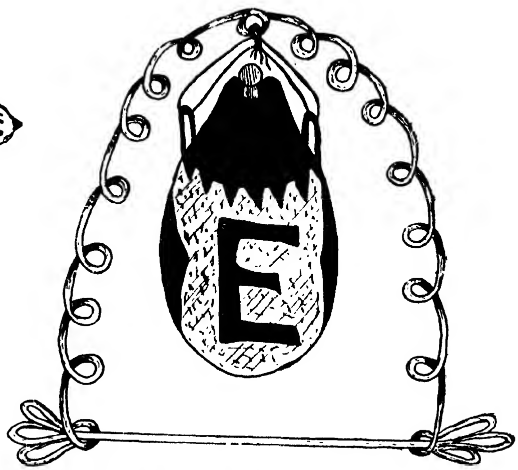


Fig. 256.—Hanging Perfume Bottle.

Hanging Scent Bottle.—Fig. 256 shows a hanging scent bottle. Make a hole at the small end of an egg, hold it sideways when getting rid of the contents, and break the yolk with a darning-needle. Fit a small glass stopper or a cork into the sealing-wax, embed two wire hooks at the sides near the stopper, add the initials of the recipient, and colour as desired. Soak wadding with perfume, fill the shell, and suspend from a wire or wooden support by silk cord or ribbon, tied in a smart bow.

Elastic Stocking, Cleaning

Lay the stocking on a clean board, wet a sponge with methylated spirit and rub on it some Castile soap; with this clean the stocking on both sides. Finish by sponging thoroughly with clean spirit, and allow to dry.

Electric Alarms

Electric Door Alarm.—In fixing this automatic device, first decide where to have the electric bell. This should have a $2\frac{1}{2}$-in. or 3-in. gong, and would ring well with one Leclanché cell through a circuit of 20 yd. or 30 yd. of wire. Place the bell 7 ft. or 8 ft. high, where it will be heard well. If possible, fix it with two screws to the woodwork. An expanse of wood intensifies the sound. (Particulars of electric bell work are given later.) Place a No. 2 Leclanché or a dry battery in a box somewhere convenient, but out of sight. Make the door connection as follows: Cut a piece of brass plate $\frac{1}{16}$ in. thick and 2 in. by $\frac{1}{2}$ in. Bend one end over $\frac{1}{4}$ in. at right angles, as shown at H (Fig. 257), which shows an edge or side view. File up neat, drill a hole in the middle, and rivet a binding screw in. If preferred, solder over to ensure good contact. Drill a screw-hole each side and screw this piece to the door 2 in. from the hinge post, as at F (Fig. 258), and allow $\frac{1}{4}$ in. to project above the top edge. Now cut a similar piece $1\frac{3}{4}$ in. by $\frac{1}{2}$ in. Fix a binding screw in the middle, and drill screw-holes as before. Screw this to the hinge post an inch or so from the edge and parallel with the other plate, as at E (Fig. 258). Coil a piece of springy brass or copper wire around a lead pencil, and connect the two binding screws with it. This makes a perfect contact which contracts or expands when the door opens or shuts. Next cut a piece of brass or copper plate, somewhat less than $\frac{1}{16}$ in. thick, to the shape of Fig. 259 and $\frac{1}{2}$ in. wide. Drill three holes and fix a binding screw in the centre, as shown at D. The curve A is the same as the arc described by the brass plate on the door when the latter opens, and should be of just sufficient length to break connection with the lower plate when the door is wide open. Bend the drilled part to a right angle at B, taking care that the sweep A is the proper way. The latter is bent at C (Fig. 257), which shows the edge, and is arranged to make contact when the door is 6 in. open. Curl the end

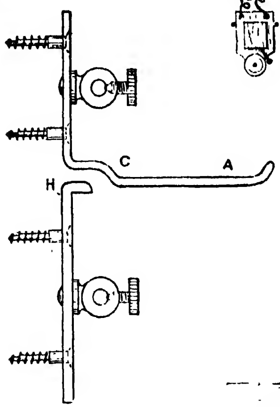


Fig. 257.—Top and Bottom Contact Pieces of Electric Door Alarm.

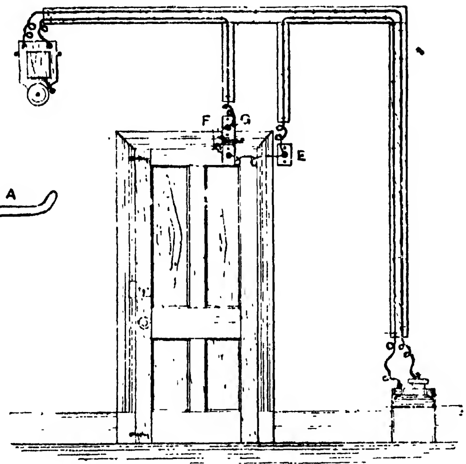


Fig. 258.—General Connections for Electric Door Alarm.

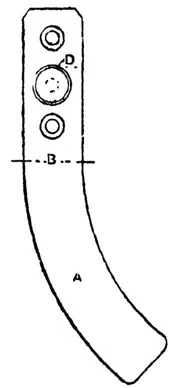


Fig. 259.—Top Contact Piece of Electric Door Alarm, before Bending.

up as shown, so that the plate will spring up slightly when the door shuts. Next screw this plate at G (Fig. 258) in a line with the door-plate on the wood above the latter, but low enough to make a good springy contact. The constant rubbing of the plates ensures their keeping clean, thus preventing any obstruction to the electric current. All is now ready for the connections. Measure up for, and get twin cotton-covered copper wire. Bare the end 6 in., coil each separately around a pencil, and

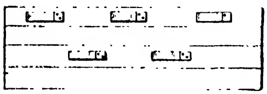


Fig. 260.

Fig. 261.

Fig. 260.—Electric Alarm Matting.
Fig. 261.—Spring for Electric Alarm Matting.

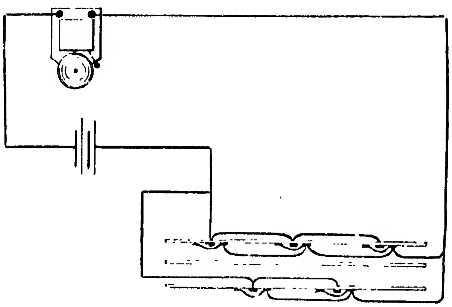


Fig. 262.—Connections for Electric Doormat Alarm.

connect to the two terminals on the bell. Then staple the wire neatly every foot or so towards the contact plates. When it reaches between the top and side plates G and E, cut one wire and unwind the covering sufficiently to allow each end to connect to the binding screws. This done, continue the wire to the battery. Bare the end 6 in., and connect one wire to the carbon terminal and the other to the zinc. Fill the cell and porous pot with a solution of sal-ammoniac (2 oz. to the pint of water), and the job is complete. When the door opens and shuts, the bell will ring if the wire is not broken. It is a good plan to test this, before using, by connecting the wires at one end to the battery, and the other to the bell. If the wire is all right, the latter will ring. Fig. 258 is a diagram showing the general arrangement as described. If the battery is between the door and bell, one of the wires can be cut nearest it, the ends then bared, and another wire soldered to each end connected to the cell. The other end of the line is then bared and fastened to the binding screws on the plates G and E. If preferred, a switch may be interposed in the circuit, so that the latter can be broken temporarily at any time. If more than one cell is used in the battery, connect the zinc of one to the carbon of the next. The cost of such an alarm will not be very great.

Electric Door Alarm hidden under Door-mat.—An electric alarm is commonly fixed in such a position that when a person steps on a doormat the bell will ring. It is fitted in the following way: Lay a square of electric alarm matting on the floor under the doormat and connect the matting to an electric bell. This matting, which can be obtained at about 2s. per square foot, is simply a number of laths (as Fig. 260) connected together by stout webbing, each alternate lath having a curved metal spring (as Fig. 261) and contact piece. All the metal springs are connected to one part of the electric bell circuit, and all the contact pieces to the other part of the bell circuit, as shown in Fig. 262. When a person steps on any part of the doormat, his weight brings one or more of these springs into contact, and rings the bell. When the weight is taken off, the springs raise the mat and the bell ceases to ring because the circuit is then broken. The connecting wires are concealed beneath the webbing and are connected to the line wires under the floor, not left open as shown in the diagram (Fig. 262).

Electric Time Alarms.—(a) In Fig. 263, A represents an alarm clock, B the bell, and C the cells (wet or dry). The pieces D, E, and F are shown separately and enlarged at Figs. 264 to 266. Fig. 264 shows a long, thin screw hook, whilst Fig. 265 consists of a brass flat plate with a hole drilled for screwing to a flat surface. The hook (Fig. 264) is fixed about 1 in. away. The piece shown by Fig. 266 is a plate slightly weighted. The pieces D and F are hinged together, and

when the alarm goes off, the piece F drops on the piece E, and the alarm will be completed. The piece F is connected to the hammer of the clock by means of a piece of thread,

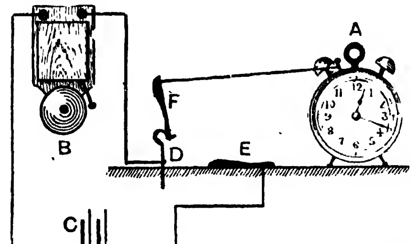


Fig. 263.—Connections for Electric Time Alarm.

Fig. 264. Screw Hook.

Fig. 265.

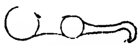


Fig. 266.

Figs. 265 and 266.—Brass Plates for Electric Time Alarm.

a hole being bored in F for this purpose. (b) The electric alarm now described will suit any of the cheap foreign clocks. First remove the movement from the case, and take off the set-hand, pin, and wheel of alarm, so as to get at the flat brass spring that releases the hammer. To this spring solder a small piece of platinum. Next drill and tap in the frame a small hole that will not interfere with any of the works. Now measure the length from the hole in the frame to the platinum on the spring, and from thin sheet brass cut a link similar to A in Fig. 267. Drill a hole in one end of the link large enough to admit an insulating bush to go round the screw, and solder a platinum tip on the other end, as shown at B (Fig. 267). For this make a hard wood insulating block (Fig. 268), and a washer with a hole in it to admit the screw, as shown in Fig. 269. Next strip one end of a small piece of insulated wire and solder it to the link, and fix the latter and the block together on the frame. Adjust this so that the two platinum tips come together (as in an ordinary push button) when the pin is in the notch in the collet of the wheel, or, in other words, when it is time for the alarm to ring. Fit two terminals to the case: if for a carriage clock, as shown in Fig. 267, they will be best on the base edge. For a drum clock they might be brought near the top. If the movement makes metallic contact with the case, one terminal must be insulated from the same. Next fix the movement in the case, and connect the wire from the link (Fig. 267) to the terminal that is insulated. If the movement is not in metallic contact with the case, a wire must be soldered to the frame and run to the other terminal, and the clock is complete. Two brass pins (Fig. 270), that will go into the holes in terminals, may be fixed to some flexible wire, so that the clock may be placed in any desired position; if the pins are removed from the terminals the clock may be taken about without any of the other arrangement. There may be a switch in circuit, or disconnecting one of the pins from its terminal will break circuit at once. The bell and battery can be fixed anywhere out of the way and connected to the terminals. (c)

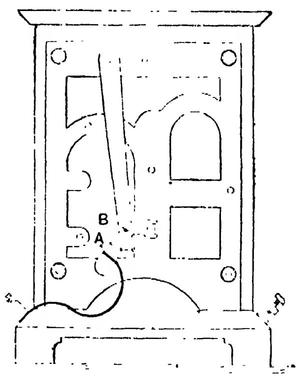


Fig. 267.—Electric Alarm applied to Cheap Clock.

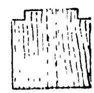


Fig. 268.—Insulating Block.

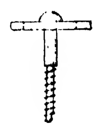


Fig. 269.—Washer and Screw.

Fig. 270.—Brass Pin for Electric Time Alarm.

Fig. 271 shows another method of attaching an electric bell to a clock, the bell to ring at any given time. A is an alarm device cemented to the face of the clock.

The flexible wire at B is connected to the battery at C, and thence to the bell D and make and break switch E. The terminal connected to the pivot of the switch may

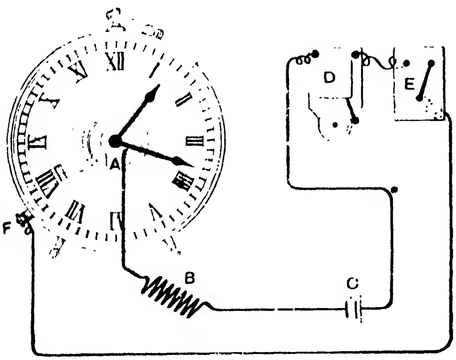


Fig. 271.—Connections for Electric Time Alarm.

be connected to a terminal F fastened on the clock-face. Thus a complete circuit is formed with the whole of the apparatus in series. (d) Assume that a clock placed, say, in the kitchen is required to ring an electric bell upstairs at 1, 3, and 5 o'clock. Prepare three tiny pieces of thin German silver A (Fig. 272), the shape of which is shown enlarged at Fig. 273. These pieces of silver are to be fixed to the dial of the clock in the position shown at Fig. 272, so that the hour hand shall come into contact with the back B of the upturned pieces at 1, 3, and 5 o'clock. These pieces must therefore be bent to form a spring, only lightly scraping the hand as it passes over them. Short lengths of No. 26 copper wire must be soldered to each piece before it is fixed on the dial, and this wire will connect to a binding screw on one side, as shown by the dotted lines in Fig. 272. The contact pieces of German silver may be fixed to the dial with glue or seccotine, or attached with fine screws. The connecting wires may be led either over the face of the dial or behind it. A wire from the binding screw above mentioned will go to the bell, and a wire from another binding screw connected to the works of the clock will go to the battery. The arrangement can be tested by turning the hands, as if correcting the time.

Electric Batteries

Bichromate Battery.—Fig. 274 shows a neat little bichromate battery. The cells are two glass jars, each about 6 in. high, 3 in. long, and $2\frac{1}{2}$ in. broad. A piece of hard wood 1 in. square spans the two cells when they are placed side by side, and holds all the fittings. The $\frac{1}{2}$-in. zinc rods Z Z pass through holes bored in this piece of wood with a centre-bit. A carbon plate on each side of each zinc rod is secured by screws passing through the tops of the carbons. A strip of brass on each carbon, in the form of brackets, forms connections for spirals of No. 22 silk-covered wire, connecting these elements with the zinc at A and the terminal B. Brackets of thicker brass, each carrying a brass set-screw, are mounted on the top and make connection with the zinc rods. The binding screws B B can be connected to a 4-volt lamp by spirals of No. 22 brass wire S S. The lamp is supported in a bent loop of iron wire fixed in the wood support. A neat box, with the upper half hinged as shown in Fig. 275, holds the cells and provides ready access to the fittings and connections at any time.

Bottle Bichromate Battery.—A bichromate battery is very useful to an experimenter in electrical work which requires a powerful current of not more than 2 volts pressure. One of the most handy forms of this battery is a single cell made with a bottle so shaped as to be easily handled by the operator.

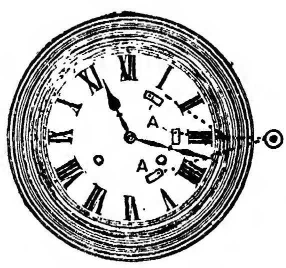


Fig. 272.—Clock with Electric Alarm Applied.

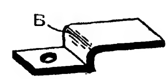


Fig. 273.—German-silver Spring for Electric Time Alarm.

This bottle bichromate battery, a general view of which is given in Fig. 276, may be made in the following manner. The bottle used must be large enough to hold $\frac{1}{2}$ pt.

or more of water, and the mouth must be wide enough to take the strips of carbon K and zinc Z. Special bottles, similar to that shown, are made and sold for the purpose. An ordinary pickle or jam bottle, or the glass cell of a Leclanché battery, may be utilised

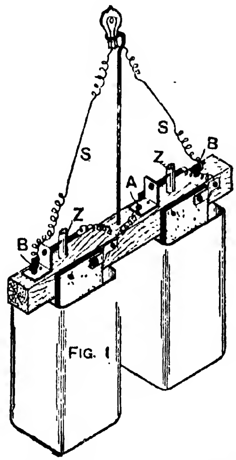


Fig. 274.—Two-cell Bichromate Battery.

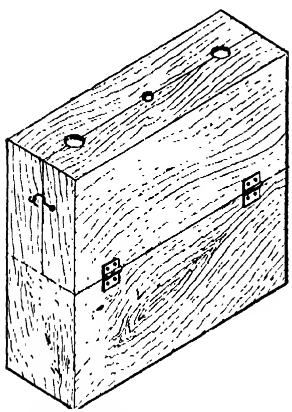


Fig. 275.—Box for Two-cell Battery.

if desired. Unless the space for the battery is limited, a larger size is not objectionable, as the charge will then last longer, and the current will be stronger than from a small cell, but, of course, of no greater pressure. The plates must be chosen to fit the cell. Two carbon plates wide enough to fit the neck of the bottle, and long enough to reach from the cover to within $\frac{1}{2}$ in. of the cell bottom, will be required, and one zinc plate of the same width but only half the length of the carbon plates. The zinc plate will be suspended in the cell between the two carbon plates, as shown, with not less than $\frac{1}{4}$ in. clear space on each side. If the zinc touches the carbons, the battery is useless. The plates may be $\frac{1}{4}$ in. thick; the zinc plate should certainly not be thinner. The top of each carbon plate, to the depth of $\frac{1}{2}$ in., must be coated with copper, to form a connection with the solder employed to join the plate to a strip of brass or copper. The coppering process may be done as follows. Make a pint of saturated solution of copper

Fig. 276.—Bottle Bichromate Cell.

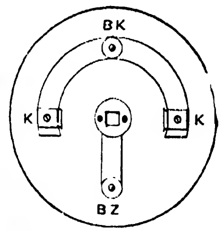


Fig. 277.—Cover for Bottle Bichromate Cell.

sulphate in rain-water, and put it in a stoneware jar. Stand in this a small porous cell nearly filled with dilute sulphuric acid. In this have a rod of zinc coated with mercury. Twist a piece of No. 22 copper wire around one end of the carbon plate, and attach the other end of the wire to the zinc rod; then immerse the other end of the carbon plate in the copper solution to the depth of $\frac{1}{2}$ in., supporting the wire and carbon on a strip of wood. In a few minutes the carbon will receive a coat of copper, and at the end of an hour it will be thick enough for the purpose in hand. Well rinse it in hot water, and dry by rubbing in hot sand or sawdust. A small strip of copper or brass, bent to the form of a clip, may now be soldered to the coppered end of the carbon, after which the coppered part and connection

is coated with paraffin wax, varnish, or Brunswick black. The two carbon plates, thus prepared, may now be set aside until the zinc plate has been got ready. The upper edge of the zinc plate must be soldered to a connecting shank of brass or copper, and this shank must fit loose in a connecting socket fixed on the cover of the cell. This shank will be used to slide the zinc plate up and down in the solution as required. It must therefore be long enough to stand at least ¾ in. above the cover when the zinc is touching the bottom of the cell. A square rod will be the best shape, and the lower end should form a clip into which the zinc is fitted and soldered. This joint should then be coated with Brunswick black, or an insulating varnish not easily attacked by acid. The zinc must next be coated with mercury. This is best done in a stoneware pie-dish containing the mercury and a strong solution of sulphuric acid, the zinc being rubbed with a wisp of tow whilst wiping the mercury over it. The zinc must be thus coated every time the battery is cleaned and recharged. This rule applies to the zinc element of all bichromate batteries. The cover of the battery is made of hard wood, in the form of a bung, with a projecting rounded flange about ¼ in. thick, to make a kind of platform for the fittings. Two holes must be made in this, close to the sides, for the carbon connections, and one hole in the centre for the connecting socket of the zinc. The wood disc should then be well soaked in molten paraffin wax, and, when cool, well polished by rubbing with a rag. The brass fittings and terminals should be fixed to the upper surface of this cover, as shown diagrammatically in Fig. 277. The brass socket in which the shank of the zinc plate slides should be stout enough and high enough to hold a brass set-screw, to tighten the shank and hold the zinc plate at any required height in the solution. This socket is to be soldered to a brass strip connecting it with a binding-screw, as shown at B Z. A semicircular strip of brass connects the two copper strips K from the carbon to another binding screw B K. These strips are best connected with screws for subsequent easy removal when it becomes necessary to clean the carbon plates thoroughly or to renew them. To make the solution to be used in this and all other forms of single fluid bichromate batteries, dissolve 3 oz. of bichromate of potash in 1 pt. of hot rain-water, and set it aside until quite cold. Then add to it slowly, in a fine stream, or drop by drop, whilst being stirred, 3 oz. of strong sulphuric acid. Should the solution become warm by adding the acid, it must be set aside until quite cold before it is put in the cell. If this is not done, the zinc plate will be violently attacked, even when well coated with mercury. The zinc element must be lifted out clear of the solution when the battery is not in use, to keep this and the zinc in working order. As the battery is worked, the colour of the solution will alter from orange to greenish-brown; then to a blackish-brown tint, denoting exhaustion, when it must be renewed, and the zinc freshly coated with mercury.

Dry Cells.—Cells made as here explained have given every satisfaction when used for bell ringing, telephone working, etc., their life ranging, according to the work to which they are put, from eight to eighteen months. When run down, they may be partially restored if connected to a suitable electrical circuit for three or four hours, similarly to the manner in which accumulators are charged. A useful size, if the cell is cylindrical, is 3 in. in diameter by 7 in. high. This will have an internal resistance of about ·25 ohm, and an electro-motive force of 1·5 volts. Cut a piece of No. 20 B.W.G. sheet zinc 10 in. by 7 in., roll it round a short length of 3-in. pole or pipe, lap the seam ½ in., and solder carefully. Use unkilled spirits diluted to about half strength as a flux, a very hot soldering bit, and thin wire solder. One end must now be closed by soldering in it a disc of zinc, and the cell will be ready for fitting. Two separate mixtures are used for charging the cell: one, a plaster, being applied immediately to the zinc, and the other, a moist granular mass, being packed closely around the central carbon electrode. For the first, use plaster-of-Paris (finest), 50 parts; pure ammonium chloride, powdered, 25 parts; rain-water, 25 parts; and glycerine, 4 parts. For the second, employ crushed retort carbon, 50 parts; pure

ammonium chloride, powdered, 25 parts; best crushed black peroxide of manganese, 25 parts; zinc chloride (concentrated killed spirits of salts), 5 parts; and glycerine, 4 parts. For the cell under construction, $14\frac{1}{10}$ cub. in. of plaster-of-Paris, 7 cub. in. each of ammonium chloride and water, $1\frac{1}{8}$ cub. in. of glycerine, $14\frac{1}{10}$ cub. in. of carbon, 7 cub. in. each of ammonium chloride and manganese peroxide, $1\frac{2}{5}$ cub. in. of zinc chloride, and $1\frac{1}{8}$ cub. in. of glycerine, will be wanted. Any very small jar may be used as a measure if its capacity is known. For example, a jar 2 in. in diameter by $1\frac{1}{2}$ in. deep will have a capacity of $2 \times 2 \times \cdot 7854 \times 1\frac{1}{2} = 4 \cdot 7$ cub. in. For the necessary quantity of plaster-of-Paris or of carbon, the jar would be tightly filled $\frac{14 \cdot 1}{4 \cdot 7}$ = three times, and with each portion of ammonium chloride, manganese peroxide, or water, $\frac{7}{4 \cdot 7}$ = one-and-a-half times. In the foregoing, the amount of material displaced by the carbon block and by the sealing cap has been neglected. For the convenience of those who desire to construct larger or smaller cells, according to the instructions given, the following table of multipliers and approximate internal resistances will prove useful:

Size of Cell. Inches.	Section. Circular.	Section. Square.	Internal Resistance. Ohms.
$1\frac{1}{2}$ by $3\frac{1}{2}$	·0352	·045	·7
2 by 5	·0897	·114	·4
$2\frac{1}{2}$ by $5\frac{1}{2}$	·154	·196	·35
3 by 7	·282	·36	·25
4 by $8\frac{1}{2}$	·61	·77	·18
5 by 11	1·23	1·57	·1

Having measured out all the materials, take those for No. 1 mixture; dissolve as much of the ammonium chloride as possible in the water, add to it the glycerine, and, with the solution, mix the plaster and the remainder of the ammonium chloride in the ordinary way. As the plaster sets rapidly, no time must be lost in coating the inside of the cell to a depth of about $\frac{3}{8}$ in. When this is set, trim off level $\frac{3}{4}$ in. from the top. Drop into the bottom of the cell at the centre a small piece of glass, and on it stand a carbon plate $7\frac{1}{2}$ in. by $1\frac{1}{4}$ in. by $\frac{1}{4}$ in. Thoroughly incorporate the materials of the No. 2 mixture, and then pack it in all round as tightly as possible. The plaster coating must on no account be pierced, nor should the black mixture (No. 2) come higher than it. The $\frac{3}{4}$-in. space above the charging materials is for the sealing cap, which, after a small brass terminal has been attached to one side of the cell, is made by pouring a molten mixture of pitch 7 parts and resin 3 parts until level with the rim. When this is set hard, make a $\frac{1}{8}$-in. hole through the cap with a hot wire. A suitable binding-screw should now be fitted to the top of the carbon plate, and the cell finished by pasting round it two or three layers of paper and a final covering of bookbinder's grained paper or leatherette. A formula somewhat easier to work than that given above is as follows: For the No. 1 mixture, soak about 21 cub. in. of clean elm or oak sawdust in a solution consisting of water, 7 oz.; ammonium chloride, $2\frac{1}{2}$ oz.; zinc chloride, $\frac{1}{2}$ oz.; glycerine, $\frac{1}{2}$ oz.; glue, $\frac{1}{2}$ oz. Coat the inside of the cell with this. Mixture No. 2 is crushed retort carbon, 2 oz.; manganese peroxide, $\frac{1}{2}$ oz.; ferric oxide, $\frac{1}{4}$ oz.; glycerine, $\frac{1}{4}$ oz.; with sufficient common treacle added to bind the whole together. This is packed round the carbon plate, and the cell may then be sealed.

Flash-lamp Battery. To make a flash-lamp battery, obtain a piece of thin sheet zinc, 1 ft. long by 6 in. wide, and cut it into three pieces 6 in. by 4 in., and from each of the pieces cut off a 1-in. by 4-in. strip. With these pieces make three zinc cells one 1 in. square, the others D-shape, as shown in plan at Fig. 278. Solder the edges, and fit a zinc bottom to each, cut from one of the narrow strips; then solder all joints water-tight. Having made the cells, solder a 2-in. length of electric bell line wire to each, as shown at Fig. 279. Next obtain three rods of carbon, of any section (electric arc lamp carbon will do), and cut three pieces to the same length as the zinc cells; then fit a small brass cap or collar tight to each carbon. Next make three small canvas bags to hold the carbon and form the inner cells; they must be as long as the carbon

rods, and just large enough to go into the zinc cells and leave a little space around when full. The carbon rods must be packed tight in these bags with a pasty composition made of finely powdered carbon and manganese dioxide, of each 5 parts; chloride of zinc and sal-ammoniac, of each 1 part; glycerine, $\frac{1}{2}$ part; and water, 1 part. The use of glycerine is to retain moisture in the cells. It does not cause the contents to cake dry and hard. This they will do more rapidly when exposed to air, if glycerine is not added to the mixture. Chloride of zinc is hydroscopic—

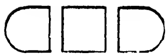


Fig. 278.—Plan of Three Zinc Cells.

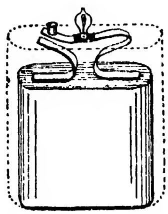


Fig. 281.—Flash-lamp Battery Connected to Lamp.

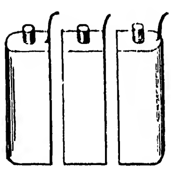


Fig. 279. Cells with Wires Soldered On.

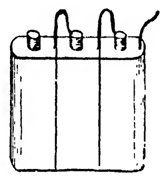


Fig. 280.—Flash-lamp Battery ready for Sealing.

that is, it will absorb moisture from moist air and is therefore one of the non-drying agents employed in making these cells. But glycerine prevents evaporation of water from the cells by coating the contents with a thin film. In spite of this, these cells will part with their water and become dry and hard after being in use for some time. They will get in this condition more rapidly if the tops of the cells have not been sealed with pitch mixture, if they are exposed to a high temperature, and after they have done much work (just before complete exhaustion). Returning to the actual details of construction, dissolve the sal-ammoniac and zinc chloride in the water, add the glycerine, then make the whole into a stiff paste, which must be rammed in tight around each carbon rod. The powdered carbon in this paste is merely that of crushed battery plates or of arc-light rods. When the bags are full, tie each one tight round the top, under the cap on the carbon, with strong waxed twine. Put a bit of cardboard in each zinc cell for the bags to rest on, then put in the filled bags, and fix them in the centre of each cell with a flour paste made as follows: Dissolve $\frac{1}{2}$ oz. of sal-ammoniac and $\frac{1}{4}$ oz. of zinc chloride in 4 oz. of warm water, then add $\frac{1}{2}$ oz. of glycerine, and 1 teaspoonful of flour rubbed into a smooth paste with some of the above mixture. Boil the mixture, and pour it into the cells whilst hot; then set aside to get cold. When the mixture has become quite cold and firm, solder the wire from one zinc to the carbon rod of the next cell, and the wire from the zinc of this to the carbon rod of the next, thus forming two loops of wire, and leaving one end free, as in Fig. 280, which shows the battery ready for sealing. Get two strips of paraffined cardboard to separate the cells, and some strong black paper to form a case for the battery. This case is made by pasting several folds of the paper around the three cells with the two strips of cardboard in between them. The case should come $\frac{1}{2}$ in. above the rims of the cells. Now solder a **V** spring of hard sheet brass or German silver to the free carbon cap, and another to the zinc cell at the other end, or to the wire attached to the zinc (*see* Fig. 281). These springs will make contact with other strips of brass connected to the lamp in the cover of the lamp case. This done, seal the cells with a composition made of pitch, resin, and paraffin wax in equal parts, made hot in an iron ladle, and poured whilst hot. When this has set cold, pierce each cell with a red-hot wire to form vents for the gases generated in the cells when the battery is working. This battery is made to fit into a tin case having a small pea lamp screwed into a depression in the cover, to which is also attached springs for connecting the lamp to the battery. One of these springs only connects when it is pressed down by the push-button. An outline of the lamp case and cover is shown by the dotted lines in Fig. 281.

Leclanché Battery.—Without doubt, the most popular cell for electric-bell work is the one invented by Georges Leclanché. This cell has an electro-motive force of 1·6 volts. The outer-containing jar is almost always of glass, and square, for convenience of packing to form a battery (*see* Fig. 282), with a large round mouth furnished with a lip. The cell complete has the top of the mouth, both inside and out, for about an inch down coated with Brunswick black, paraffin wax, or similar material that will prevent the salts formed by the contents from creeping over the edge. This coating is applied by thoroughly cleaning the jar, heating it, and either dipping the rim into melted paraffin wax, or giving it two or three coats of Brunswick black. The porous pot which goes inside the glass jar contains a carbon plate with a lead cap, on which is a binding-screw with connections. The whole of the space between the carbon and the pot, to within $\frac{1}{2}$ in. of the top, is filled up with a mixture of equal parts by bulk of crushed coke or carbon and peroxide of manganese, crushed to the size of very small peas or rice grains, sifted from the dust and packed in as tightly as possible. So as to allow the gas formed in working to escape, two little pieces of glass tube are embedded in the mixture on each side of the carbon, and then the top should be sealed up with melted pitch, or pitch and resin mixed; the top of one tube is shown in Fig. 282. The whole of the top should have two or three coats of Brunswick black, working well over the lead cap and into the top of the carbon plate, and down the outside of the top of the pot for about 1 in.; dip the bottom of the porous pot for about $\frac{1}{4}$ in. into melted paraffin wax, and the negative element is ready for use. The positive element is generally a rod of drawn zinc; if cast it is crystalline and brittle. A hole should be drilled in the top, and a stout piece of guttapercha-covered copper wire either screwed or soldered in. The joint should be well covered with guttapercha or several coats of Brunswick black. The zinc should be amalgamated by the following method. With a file remove rough excrescences, etc., and have ready two glass jars deep enough to take the zincs; one of these should be half full of water containing about a teaspoonful of sulphuric acid, the other a quarter full of the same mixture with a little mercury at the bottom. Dip the rod first in the tube with the acid and water to clean it well, then into the one with the mercury, and by holding it in a slanting position the mercury can be easily flowed all over the zinc by twisting it round. Wipe off the superfluous mercury with a rag, and the rod is ready for use. To charge a Leclanché cell, three parts fill the outer jar

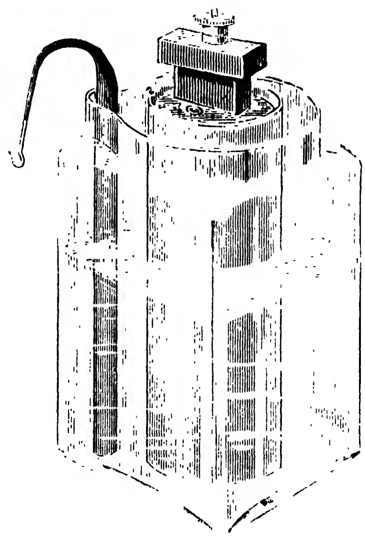


Fig. 282.—Leclanché Cell.

with a strong solution of ordinary sal-ammoniac; if the jar is filled more than this, the salts of the solution will creep up. In a few hours the cell will be ready for use. Should it not be convenient to wait, pour through the little glass tubes in the seal some of the solution into the porous pot, and the cell will be in working order in a minute or so. The chemical action that goes on during the working of the cell is this: The zinc, sal-ammoniac, and peroxide of manganese are changed into zinc chloride, water, and ammonia; and the oxide of manganese is reduced to an oxide less rich in oxygen. Using chemical signs, Zn, $2NH_4Cl$, and $2MnO_2$, become $ZnCl_2$, $H_2O + 2NH_3$, and $Mn2O_3$. Where a good, full current is

wanted for short periods at intervals—such as for electric bell work—a cell of this type is suitable: it is of no use where continuous currents are needed, as it polarises quickly, recovering itself, however, equally

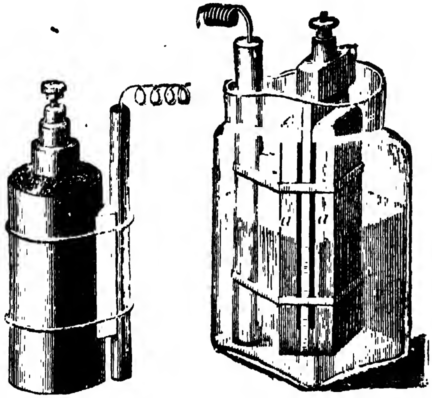


Fig. 283. Fig. 284.

Figs. 283 and 284.—Elements and Complete Arrangement of Agglomerate Leclanché Cell.

rapidly. It has another advantage—action does not go on inside the cell unless the circuit is closed and the cell is doing work; therefore it can stand for months always ready charged without any fear of the zincs being eaten away; moreover, it is not affected by changes of temperature, and does not give off noxious fumes. These facts make it of the greatest use for bell work, etc.; but for lighting, driving motors, and similar work with which this volume is not concerned, it is practically useless. The Leclanché battery has undergone several changes, and in one form the porous cell has been replaced by solid blocks of manganese and carbon clasped tightly to the carbon element by rubber bands. This is named the agglomerate Leclanché. In another form the carbon element is fluted and surrounded by six of these agglomerate blocks, thus still further reducing the internal resistance. In still another form the position of the elements is reversed, the zinc rod being placed in the porous cell. In another (the Victoria Leclanché), the zinc element is used in the form of a plate in a rectangular cell. None of these has superseded entirely the original form of the Leclanché cell. A comparatively new departure from the old style Leclanché cell—named the Carporus, or central zinc Leclanché—has the agglomerate block for each cell in the form of a porous cell, in the centre of which the zinc element is suspended. The internal resistance is thereby reduced to $\frac{1}{2}$ ohm in the large sizes, and to 1 ohm in the smallest size. An agglomerate Leclanché is of simple construction and can be easily made. Figs. 283 and 284 show two forms of the negative element, the chief feature being the absence of the porous pot. The mixture is nearly the same, but is made into blocks by using an adhesive medium, and by heat and pressure; one form is a solid block, and the other is two plates *a a* (Fig. 284), one on each side of the carbon. The result is that the internal resistance of the cells is somewhat reduced. The zinc or positive element is held in its place by indiarubber rings, and is kept from touching the block by a strip of wood. In making for home use an ordinary Leclanché cell, stone or glass quart jam jars with large mouths and free from cracks should be thoroughly cleaned and waxed, or painted with Brunswick black, as previously described. In place of a porous pot a bag may be used made from a square of good thick close canvas 8 in. by 7 in. Stitch together into the form of a round sack or bag (*see* Fig. 285) with a

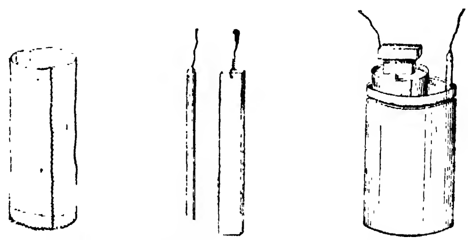


Fig. 285. Fig. 286. Fig. 287.

Figs. 285 and 286.—Canvas Bag and Elements for Leclanché Cell.
Fig. 287.—Home-made Leclanché Cell.

round flat bottom. Dip $\frac{1}{2}$ in. of the bottom several times into melted paraffin wax and dip 1 in. of the top into hot pitch and resin. It is not advisable to make the carbon plate; a 7-in. by 2-in. plate can be obtained very

cheaply. Next make a small wooden box, the inside dimensions being the size of the lead cap required; screw on one side so that it can be removed when desired; hold the end of the carbon plate in the middle of the little box, and fill up with molten lead. A great number of heads can be cast in a wooden box like this before it is burnt up. While the lead and the top of the carbon are quite hot, give them a coat of Brunswick black, working it well into the joint, and down the carbon for about an inch below the lead. It is at this joint of the lead and carbon that the creeping salts do damage and eat away the cap. Now drill the cap and screw in a small binding screw, or solder on a length of guttapercha-covered copper wire; screws are better than solder, as the latter is apt to decay under the action of the salts. Pack and seal the bag with the mixture before mentioned, coat with Brunswick black and the negative element is ready for use. A drawn zinc rod, amalgamated as before described, should be used; but shift can be made by using a strip of rolled zinc $\frac{1}{8}$ in. or so thick, 7 in. long by 1 in wide. Drill a hole through the top, slip the end of the wire through and twist it up, then solder, and cover the joint with guttapercha (*see* Fig. 286), making a joint not likely to give way. The zinc strip should be amalgamated in the same way as the rod. Charge the cell with sal-ammoniac solution the same as for an ordinary Leclanché, and it will work in a very short time. Fig. 287 shows this home-made cell complete; two such cells, if carefully made, will ring a $2\frac{1}{2}$-in. or 3-in. bell. It is usual to keep Leclanché cells in a wooden box, which protects them from accidental damage and from dust. The box may be securely covered, and the wires brought out through the back or side. Often the cover and one side of the box are hinged to each other and to the bottom, the cover opening from the back. When constructed in this way, the cover and side fall down when opened and allow free access to the cells. It may be remarked that such a box is suitable for a Gassner battery, but it is advisable to have a thin partition of wood between each cell to prevent accidental contact. In arranging a suitable place for the Leclanché cells in installing an electric bell system, it should be borne in mind that they work best and last longest when in a moderately cool and damp room, such as a cellar. In dry situations the solution rapidly evaporates, and the salts creep up the sides of the cells and over the connections. If the outsides of the glass cells are allowed to get dirty or are left wet, or stand on a wet shelf, a part of the current will be lost by leakage. Cells must be looked to from time

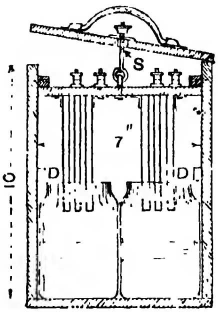


Fig. 288.—Section of Portable Bichromate Battery.

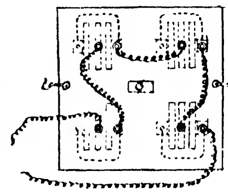


Fig. 289.—Terminal Board for Portable Battery.

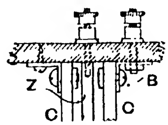


Fig. 291.—Fixing Plates of Portable Battery.

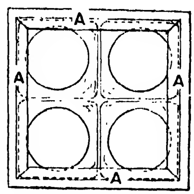


Fig. 290.—Plan of Cells of Portable Battery.

to time, and all causes of leakage stopped; at the same time, the loss of solution from evaporation must be made good by the addition of water; it is not necessary to add sal-ammoniac. It is a dirty and tedious job to clean and recharge old Leclanché cells. Scrape off from the top of the porous pots as much of the old salts, etc., as possible; then allow the pots to soak, and wash them in warm water to every quart of which has been added a small wineglassful of hydrochloric acid. After that, rinse well in clean water, clean up the binding screws, and give the tops two coats of Brunswick black. Wash and clean the glass containing jars, using hydrochloric acid to

remove obstinate dirt. Wash the zincs in hot soda water, and rinse in clean water. Rub them over with a fairly strong solution of sulphuric acid, and with mercury to reamalgamate them, and coat the tops with Brunswick black. Make a saturated solution of sal-ammoniac in warm rain-water; if this latter cannot be obtained, use tap water. When cold fill up the outer jars, and leave the cells to rest for an hour or so before using them. See that the ends of all wires and connections are bright and clean before joining up.

Portable Bichromate Battery.—This battery, charged with the usual solution of bichromate of potash or chromic acid, will be found very handy for lighting an 8-volt lamp or working induction coils, motors, etc., and, with care, can easily be carried about when charged. Fig. 288 is a section of the battery, and shows the method of holding the elements out of the liquid while being carried about. When the thumbscrew S is tightened up, the carbons and zincs are held rigid, and the box is made practically water-tight. Fig. 289 is a plan of the terminal board, Fig. 290 is a plan showing the four glass cells, while Fig. 291 shows the method of fixing the carbons C and zinc Z. The box should be of mahogany not less than $\frac{3}{8}$ in. thick when planed, the inside dimensions being 10 in. by 7 in. by 7 in. The sides must be notched or dovetailed into each other, glued and screwed together, and the lid attached with brass hinges and fitted with a brass handle. A small brass plate, with a hole bored in it, should be screwed to the centre of the lid, for the screws to pass through. A piece of mahogany is next cut about 7 in. square, and made to fit easily within the box; this is for the terminal board to which the elements are attached. Four wood strips A (Fig. 290), $\frac{1}{2}$ in. by $\frac{1}{2}$ in., are mitered at the ends and screwed to the sides at $\frac{1}{2}$ in. from the top of the box (*see* Fig. 288); care must be taken that they are quite flush with each other on the under side. Brass screws had better be used, three to each strip. These wood strips have indiarubber glued on the under side—a $\frac{1}{2}$-in. wide elastic band, or a piece of bicycle inner tube, is suitable; this will prevent leakage to any great extent if the battery should be accidentally overturned. The box and the top of the terminal board should now be french-polished, and painted inside with several coats of shellac varnish; then, if well fitted, it will be quite water-tight. The glass cells are ordinary Leclanché battery cells, No. 3 size, but any glass jar of square shape, about 5 in. deep, would do. Paper may be wrapped around each, to prevent shaking, if the cells are too loose a fit in the box. Eight carbons, 5 in. by 2 in. by $\frac{1}{4}$ in., are required, and four zincs the same size and not less than $\frac{3}{16}$ in. thick. Eight pieces of brass, $1\frac{1}{4}$ in. by $\frac{5}{8}$ in. by $\frac{1}{16}$ in., are bent at right angles, and drilled for screws and terminals, as shown at B (Fig. 291). Suitable screws, such as are used for tin trunks, can be bought at the ironmonger's; they must be of brass, and have round heads and flat nuts. The terminals are small-size telegraph pattern; and four will require nuts. One terminal is required for each pair of carbons, one carbon being attached with an ordinary wood screw to the terminal board. The pairs of carbons are connected together with thick insulated copper wire, shown by dotted lines in Fig. 289; the best way of doing this is to solder the ends to the brass angle pieces. The zincs are drilled and tapped to receive the terminal; this is the best method of attaching the zincs, as they can then be easily replaced when used up. A screw-eye is fixed in the centre of the terminal board, and a piece of $\frac{3}{16}$-in. brass wire screwed for a thumbscrew and bent into a hook, as shown in Fig. 288. The space between the carbons and zincs should not be more than $\frac{1}{4}$ in., two pins being fixed each side of the zinc to prevent it turning and touching the carbons. When all the screws are screwed up perfectly tight, all metalwork on the under side of the terminal board must be coated with thick shellac varnish or melted pitch, to prevent the acid fumes from corroding the connections; the tops of the carbons and zincs should be treated in the same way. Two small hooks are shown in Fig. 289, to hold the elements up when the battery is not in use, screw-eyes being fixed in the wood strips A. Four pieces of wood for the terminal board to rest on when lowered should be fixed at the corners of the box as shown at D (Fig. 288).

The battery cells are shown connected in series, but they can be conveniently connected up in parallel or any other combination. An alternative method of making this battery would be to dispense with the glass jars and simply divide the box into four compartments with wood partitions—each, of course, being perfectly watertight; but it would not be so satisfactory, and glass jars are better.

Electric Bells

Constructing Electric Bells.—Those who wish to make a very simple and efficient bell (*see* Figs. 292 and 293) can do so at a very little outlay by closely observing the following instructions. The parts that ought to be bought are the gong, the silk-covered copper wire, two binding screws, and a small piece of platinum wire (half the thickness and length of an ordinary pin will do) for the tips at the make-and-break arrangement. The binding screws can be dispensed with by bringing out the working ends of the wire from the bell, and making a twisted joint to the line wires; but this will not look so well. A few simple carpenter's tools, with a small drill and a soldering-bit, are all the tools needed. When nicely finished, and a neat little box made

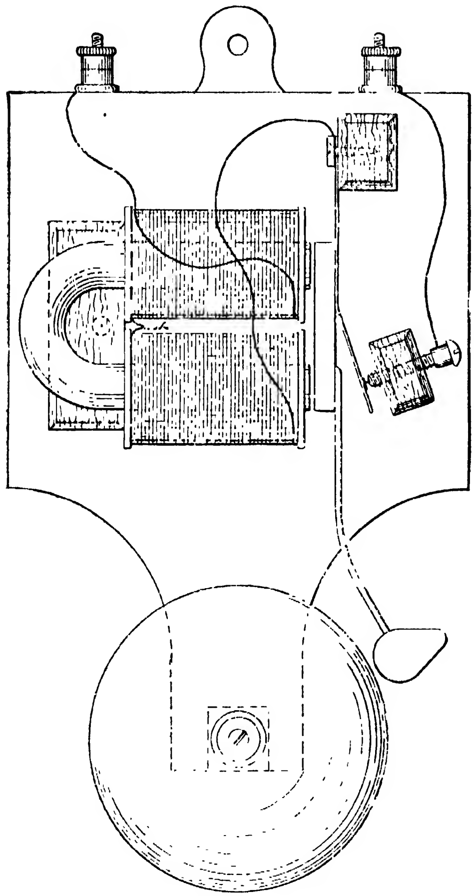


Fig. 292.

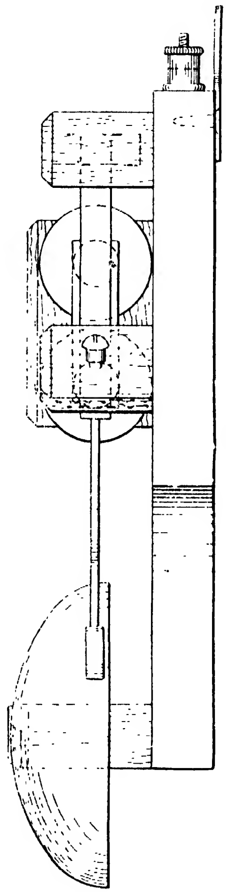


Fig. 293.

Figs. 292 and 293.—Front and Side Elevations of Electric Bell, with Cover Removed.

to cover the works, the bell looks very well. It is supposed that the gong used will be $2\frac{1}{2}$ in. in diameter. For the electro-magnet, which had better be the first part to begin with, get a piece of the softest round rod iron, not more than $\frac{3}{8}$ in. nor less than $\frac{5}{16}$ in. in diameter. Bend the iron in the form of a horseshoe (Fig. 296) so that the arms are straight for $1\frac{3}{4}$ in. of their length, and are $\frac{5}{8}$ in. apart inside. Anneal the horseshoe so that it is sufficiently soft; to do this, make it red hot in a fire or otherwise, and let it cool as gradually as possible. Dress it up all over with a file, to take off the scale, etc., and file up the faces of the two ends true and square to one another, and quite smooth. To make the bobbins shown in Figs. 294 and 295, to hold the coils of copper wire, take a round piece of wood the exact diameter of the magnet arms and about 4 in. long. Using this as a mould or mandrel, form

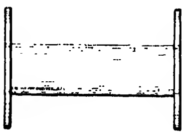


Fig. 294.

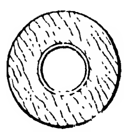


Fig. 295.

Figs. 294 and 295.—Bobbin for Electric Bell.

the barrels of the two bobbins by twisting round two or three thicknesses of brown paper; fasten with thin glue, and slip them off the wood to dry; each should be $1\frac{1}{2}$ in. long. The ends of the bobbins are cut out of wood $\frac{1}{16}$ in. thick, and barely 1 in. in diameter; this will allow them to pass each other when slipping them on the arms of the magnet. They have holes through their centres to take the ends of the paper barrels (*see* Fig. 295), which are fixed on with strong glue; the gluing should not be done until the barrels are quite dry. That part of the bobbins where the wire is to be coiled should have two thick coats of Brunswick black or sealing-wax varnish. In making the coils of any horseshoe electro-magnet which requires a north pole at one end and a south at the other, the wire, regarded from the direction of the current that will pass through it, must be coiled in a reverse way on the two arms that is, a right-hand twist on one arm and a left-hand on the other. A diagram is given in Fig. 296, and if the winding is followed in the direction of the arrows, this important matter of correct winding will be made

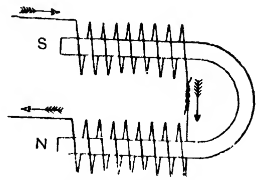


Fig. 296.—Magnet Winding for Electric Bell.

clear. In practice the best rule is to wind both bobbins alike, beginning the same end of each, with the same twist for each; slip them both on the arms of the magnet in the same way, and then join together the beginning ends of the two coils, leaving the finishing ends to work from. Fig. 296 shows that, starting from the bottom and working to the top, each coil has really the same twist, and when the two beginnings are joined at the bottom as shown, the whole coil, taken as one length, has a right-hand twist on one arm and a left on the other, which will cause one pole of the horseshoe to become north and the other south when an electric current passes through the whole coil, thus creating the strongest form of magnet. To wind the bobbins, obtain a 4-oz. reel of No. 22 B.W.G. silk-covered copper wire, and if the bobbins

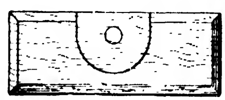


Fig. 297.

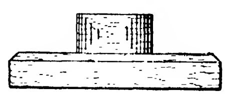


Fig. 298.

Figs. 297 and 298. Plan and Elevation of Magnet Saddle for Electric Bell.

have been made as directed, this will be more than enough, and will leave a bit to spare for odds and ends. The wooden mandrel used to mould the barrels of the bobbins on, fixed up as a little windlass

with a handle, may be used. Slip on one of the bobbins tight, and wind on six or seven layers until full of wire, winding tight and even as a new reel of cotton, and leaving 2 in. or 3 in. of spare wire at the beginnings, and 6 in. or 8 in. at the ends. Finish off by passing the end under the last loop of the coil and pulling tight. The insulation of the coils will be improved by a coat of Brunswick black, and this will also help to hold all firm. Now slip the bobbins on the arms of the magnet, as directed above, letting the ends of the magnet arms protrude about $\frac{1}{32}$ in. Bare the beginning ends of the two coils, scrape quite bright, twist close together, and then solder the joint. The magnet and coils can be given a final coat of Brunswick black, all base-board. The bell hammer, spring, and armature which plays in front of the ends of the magnet, may now be made. Fig. 300 shows the face, Fig. 301 the back, and in Fig. 292 will be seen a side view of this piece complete. In Figs. 300 and 301, at the right-hand side, there is a brass cross-piece with two holes drilled in it by which it may be screwed to the wooden block in the right-hand top corner of Fig. 292; this is also shown in the side view of the bell (Fig. 293). This piece of brass is soldered to a piece of steel spring about $2\frac{1}{2}$ in. long. This spring must be neither too stiff nor too weak—a piece of main-spring out of a small American clock does very well. It must be bent as shown in Fig. 292, and soldered to the armature,

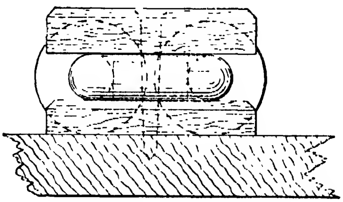


Fig. 299.—Back View of Magnet Saddle for Electric Bell.

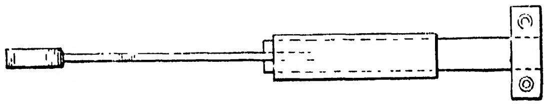


Fig. 300.

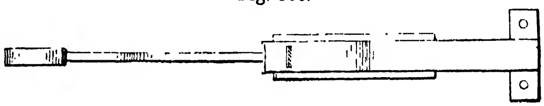


Fig. 301.

Figs. 300 and 301.—Armature Spring for Electric Bell.

except the smooth bright ends of the magnet; these can be oiled to prevent rust. Twist up the two long unconnected ends of the coil on a penholder in the form of a helix, to be out of the way until they are wanted. The base-board of the bell should be made as shown in Fig. 292, of some $\frac{1}{2}$-in. stuff, such as mahogany, which always looks well. The exact shape does not much matter. Then a small wooden saddle must be made (Figs. 297 and 298). The small piece that stands up should fit behind the bobbin ends into the bend of the magnet, and the whole should be of such a height that the bobbins rest evenly on the base-board. Fix the saddle in its place, and glue it on tight. When dry, screw it to the board from behind with two small wood screws, drop the complete magnet into its place (Figs. 292 and 293), then, by a wooden button (Fig. 299), clamp all tight with a long wood screw, passing through to screw into the which is a piece of soft iron $1\frac{3}{8}$ in. by $\frac{3}{8}$ in. by $\frac{3}{16}$ in., nicely squared and bright. At the bottom and back of armature, solder the bell hammer and shaft, made in the proportions shown in Figs. 292, 293, 300, and 301; the head is best made of brass. Near the middle of Fig. 301 may be seen a small shaded rectangle. This shows a bit of platinum which works against the point of the contact-screw (*see* Fig. 292). It is made from a piece of platinum wire hammered out flat and thin and about $\frac{1}{8}$ in. wide, then carefully soft-soldered to the back of the spring, in the position shown in Fig. 301. This can be done easily with the soldering-bit by first tinning the place on the spring and one side of the platinum. Prepare the small block of wood shown at the top of Fig. 293, and right-hand top corner of Fig. 292. Glue this to the base-board in such a position that when the spring is screwed to it by means of the

brass crosspiece, the armature shall lie fair and true before the ends of the magnet, but a little farther off than shown in Fig. 292, so that when the contact-screw in the

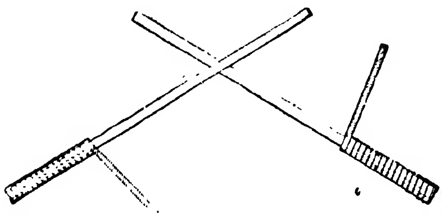


Fig. 302.—Crossed Ends of Electric Bell Wires.

lower block is screwed up there will be a slight pressure on the spring, and the armature will be brought up to within about $\frac{1}{16}$ in. from it, into the position shown in Fig. 292. For the contact-screw, take a good 1-in. brass wood screw, file the end flat, drill a hole up it, and tin it with a small spot of solder. Tin the top of a bit of platinum wire, and solder it into the hole in the screw. Cut it off, leaving only a short piece of platinum projecting. Give it two or three taps with a light hammer to flatten it, and the platinum-tipped screw is made. Make from a scrap of sheet copper a small collar that will fit round the neck of the contact screw, loose enough to allow the screw to turn, and to this collar solder about 6 in. of the spare silk-covered copper wire. Slip the platinum-tipped contact-screw through the collar, screw it through its wooden block, and glue the block to the base-board, so that the tip of the screw touches the small piece of platinum at the back of the spring. In the connecting up,

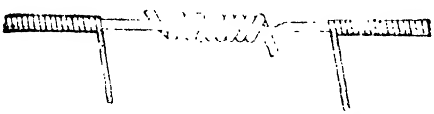


Fig. 303.—Joint in Electric Bell Wires.

as the coils on the magnet have already been joined together, only two free spirally twisted ends are left. Take one, bare the end, and clamp it under one of the binding screws at the top of the base-board of the bell; then take the other end, bare it, and solder it to the brass cross-plate at the top of the hammer and armature spring. Take the bit of covered wire that is fastened to the collar on the contact-screw, and clamp it under the other binding screw. Remember, when making connections, always to bare and scrape the covered wire, so that metal may touch metal. Fig. 292 shows the connections. Fixing the gong requires little explanation other than what is given by Figs. 292 and 293. The hammer shaft can be bent to get the head the proper distance from the gong. All the blocks, when the glue has set, should be screwed up with small wood screws from the back, but take care not to split them. Platinum points are used so as to prevent corrosion, for where there is a rapid make-and-break of an electric current there is a great deal of sparking and burning, and platinum is almost the only thing that resists it. Any

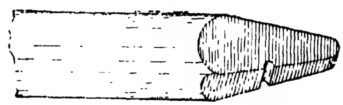


Fig. 304.—Notched Copper Bit for Soldering Electric Bell Wires.

adjustment that may be required is done by the contact-screw. To finish the bell, make a neat little box (not forgetting the slits for the shaft of the hammer and the binding screws) to cover up the works. Old cigar-boxes provide very good stuff for this purpose. Varnish all the outside woodwork nicely, and a useful bell that has cost but a few pence will be complete.

Electric Bell Wires, Jointing.—The form of joint for electrical wirework is very important. The ends of the line-wires to form the joint must be made quite clean by first stripping off all the insulating covering, and then rubbing the bare wires with emery-cloth. The two cleaned ends must be rubbed with resin and coated with solder, then crossed, as shown by Fig. 302, the left-hand end being wound tightly around the wire to the left, and the right-hand end to the right, as shown by the finished joint (Fig. 303). A little resin or candle grease is then rubbed on the joint, an assistant

holds the wire firmly in his hands, with the joint between them, and the wire is made hot by rubbing it with the hot soldering-bit. A drop of solder is then applied to the joint, which will run between the spirals of wire and solder them firmly together if the wire has been properly prepared and the joint is hot enough. Resin or composite candle or paraffin wax should always be used as a flux for soldering electric wire joints. Soldering fluids of any kind cannot be trusted, because they corrode the wire after the soldering is done, and thus make a bad joint. Some fitters prefer using a soldering-bit with a notch filed in it, as shown at Fig. 304; the joint rests in this notch, which also holds a bead of solder ready melted. Others rest the joint on a

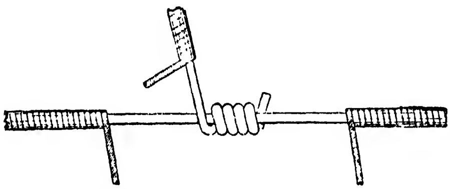


Fig. 305.—Branch Joint in Electric Bell Wires.

piece of firebrick or a fireclay lump whilst soldering it. Expert workmen use tallow and rushes and a blowpipe, or a spirit lamp and a blowpipe, or a blowlamp, to heat the joint; but there is always a risk of scorching or burning the insulation on each side of the joint, or melting the composition or rubber and getting it into the joint, when a lamp flame is used direct. The flame may be employed to heat the soldering-bit, or this may be made hot in a charcoal fire or in an ordinary fire. When heating the soldering-bit, care must be taken not to burn off the solder or "tinning." If this is accidentally done, clean off all the burnt tin with an old file until the copper surface is clean, rub the point of the bit on a lump of sal-ammoniac, and apply some solder to it, until the bit is again coated with solder. Always wipe the bit on a scrap of rag before soldering the joint, and wipe the hot joint with the same rag, to remove surplus solder and resin. To make a branch joint—that is to say, a joint for a branch wire—slice off the insulating coating from 1 in. of the line-wire, then clean the bare wire; also clean the

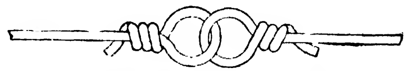


Fig. 306.—Badly Made Joint in Electric Bell Wires.

end of the branch wire, and wind it around the line-wire as shown at Fig. 305. When the joint is made, squeeze the spirals close with the pliers, and cut off the free end close to the wire. Fig. 306 represents a joint often employed in ordinary bell-fitting; it is useless because it soon corrodes, and from the first offers a high resistance. Fig. 307 represents a slovenly made joint, which will not be effective, even when twisted tighter than shown. After the joints have been soldered, wiped, and trimmed, it will be evident that as the line has been stripped of its insulation at these points, it will thus be exposed to the danger of leakage. The insulation must therefore be restored. If the outside layer of cotton has been stripped back by unwinding it, as shown in Figs. 302 and 303, the loose ends will be available as an outer or finish coat only. In braided wires this cannot be done. The inner coats in all cases will have been destroyed, and these must be renewed. These repairs were formerly done with tape and a varnish called "Chatterton's compound"; but they are now done with rubber strip ½ in. in width, rubber solution, and compounded tape. The rubber and compounded tape should be rolled on a reel. To repair the insulation of a joint, first wind on an even lap of the rubber, and coat it evenly with

Fig. 307.—Another Badly Made Joint in Electric Bell Wires.

solution; then wind on a layer of the prepared tape and then one of paraffined cotton. If the joint is made in a line coated with tarred tape to resist damp in

underground conduits, the outer coating of the joint must also be of tarred tape, finished off with a coat of Stockholm tar.

Fitting Up Simple Systems of Electric Bells. It may be of advantage to describe the fitting of an electric bell in a cottage, the push being at the front door. The wiring will be exposed, that is, the wires will be fixed to the walls by staples, the covering of the wire being of a tint in harmony with the paper. Or the lines may be laid along by the wainscoting, around the frames of doorways, and under flooring, but in this case more wire will be required than when the line is carried direct from

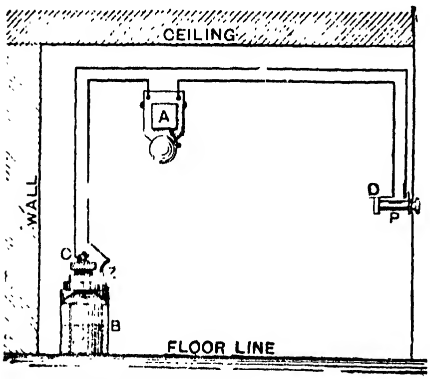


Fig. 308. Simple Electric Bell Circuit.

the door-pull P to the bell A, on to battery B, and back again (Fig. 308). It is usual to carry up the wires from the door to near the ceiling, along the top to the bell, then on to battery, and back again, as shown in the diagram, because the wires are then out of reach. The first consideration is given to the positions of the bell and battery. The bell must be located where it can be best heard. Over a doorway or on a wooden partition is a favourite position. The battery should be put in a cool, dry place, such as a dry cellar, or under the stairs; its best position is on a dry shelf. If placed on damp wood or damp stone, there will be always a danger of leakage from cell to cell, and this will shorten the life of the battery. If the chosen spot is warm, there will be excessive evaporation of liquid in Leclanché cells, and consequent corrosion of connections and metal parts by ammonia fumes and creeping salts. When choosing a spot for the battery, a little wire more or less may be disregarded in practice. It is not necessary to have the battery close to the bell. It may be in any part of the circuit, even close to the door, if that locality is convenient for the battery. A pull or a push may be used as a circuit closer for the front door of the cottage. A pull that would be suitable may be obtained either plain or bronzed, and bearing on its knob a word such as "Visitors." To fix the pull to the door-post, first bore a hole with a centre-bit to take the barrel of the pull, then bore two holes with a gimlet from the other side into this hole for the reception of the wires. Pass the wire ends through these holes, clean off the insulation, and fix them by screws to the two insulated springs of the pull; then draw the barrel into the hole, and fix the pull, by screws through its flanges, to the door-post. In Fig. 308, D represents the bell-pull contact. The line-wires, 1 in. apart, may now be led up the back of the door-post, and along the wall under the ceiling to bell and battery. Use only enough staples to hold the wire to the wall without sagging; drive each staple close enough to pinch the wire tightly, but be careful to avoid cutting through the insulating covering. When the bell is reached, one of the line-wires must be cut, the end stripped of its insulation and cleaned, the slack wound around a pencil, forming a spiral to ensure flexibility, and the cleaned end passed under the loosened nut of the binding screw, which is then screwed down tight. The other piece of line-wire is fastened in a similar manner to the other binding screw, then carried along to the battery, where its end is fixed to the zinc rod Z by twisting the two cleaned ends of the wires together as in making a joint. The other line-wire is also carried to the battery, its end cleaned, and fixed under the nut of the binding screw on the carbon element C. This completes the simplest electric bell circuit. Fig. 309 shows the connections for a system in which a bell is rung from an upstairs room as well as from the front door, a branch being led from

the connection H to the push F. Fig. 310 shows this system with the addition of an indicator G. The branch line is not jointed to the main-line wires as in Fig. 309, but only to one. The other is cut and the ends connected to two binding-studs on the indicator, thus taking one of the movements X into circuit with the bell and front door pull or push. The branch line is connected at H to another stud on the indicator, and this takes the other movement W into circuit with the bell and upstairs push.

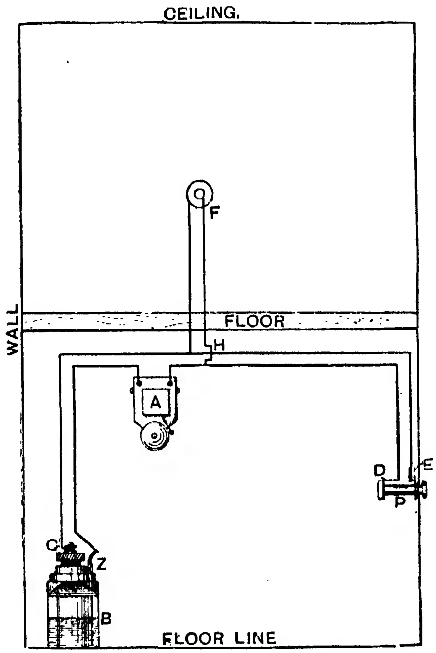


Fig. 309.—One Bell Circuit with Front Door Pull and Upstairs Push.

Installing Electric Bells and Telephones.—Crank bells are gradually being supplanted by electric bells on account of the comparatively low cost of installing the latter system, and the ease with which it can be done. Moreover, much valuable time is saved when telephones are used in conjunction with the electric bell system. If due care is taken when carrying out the work, and only the best quality of materials is used, the cost of upkeep will be merely nominal. In order to replace a crank system already installed in a building, it will be necessary to take up the floor boards, traps, etc., screwed down over the runs of the wires, and to remove the cranks, wheels, and chains, and other material used. In places where the existing wires run in tubes, remove all except one wire in each tube; this wire is to serve as a draw-wire when running the insulated wires. Remove all the bell levers and boxes, leaving the chain

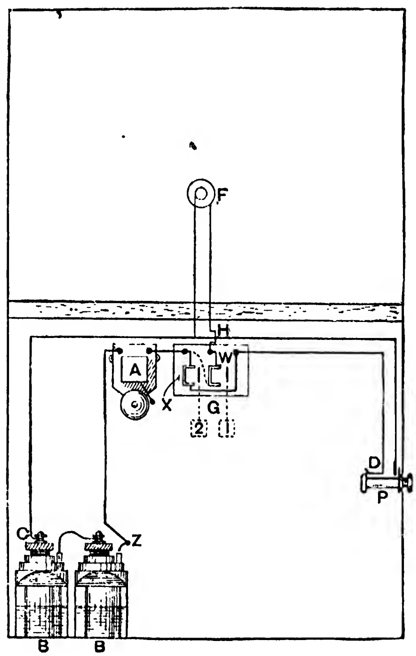
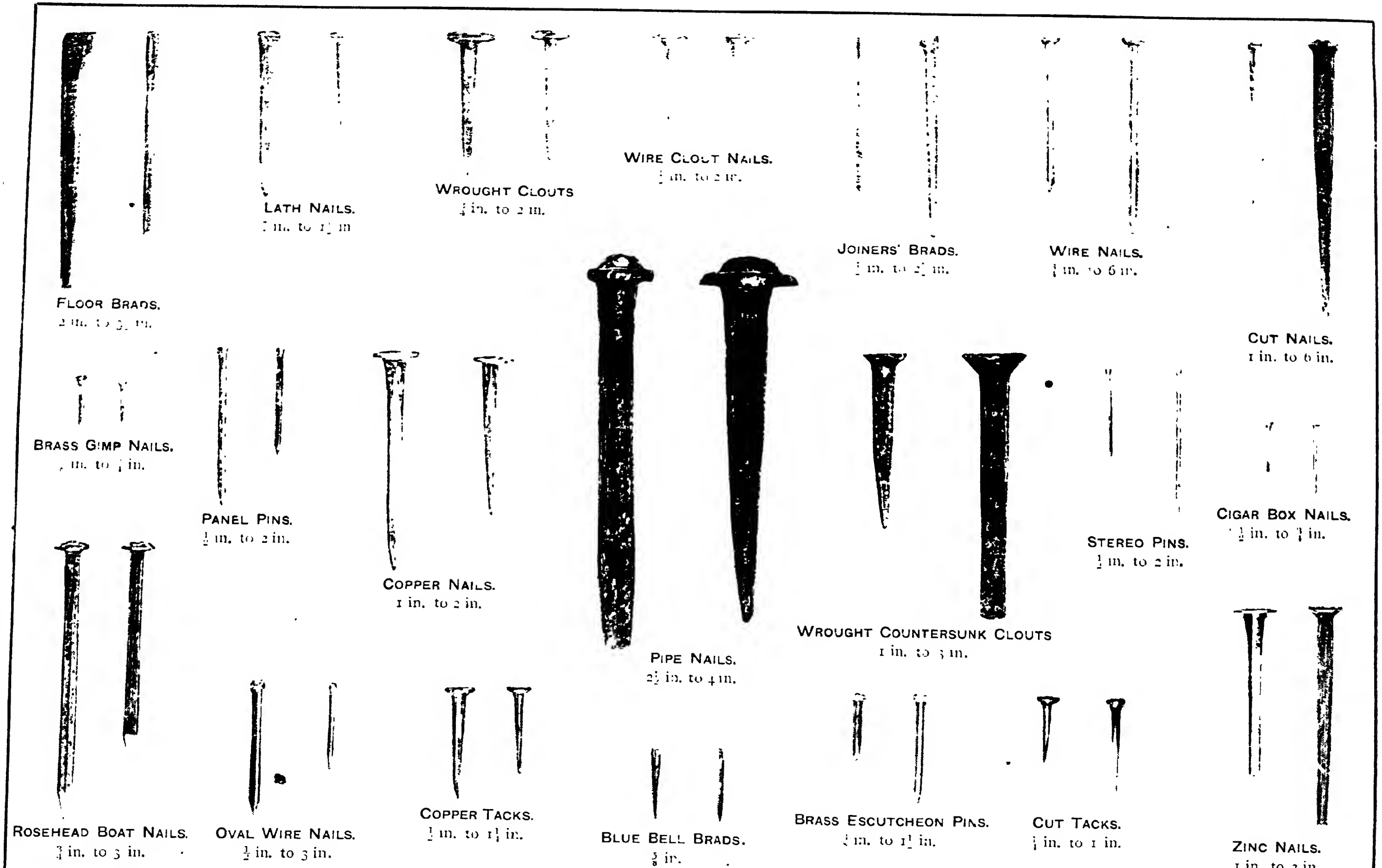


Fig. 310.—One Bell Circuit with Front Door Pull, Upstairs Push, and Indicator.

attached to the upper portion of the wire. This may be easily effected by removing the small screw tapped into the back portion of the drum. The other end of this wire must be cut as close as possible to the first crank; it will then be ready as a draw-wire. In most bell systems, zinc tubes are run vertically from the attic floor to the ground floor ceiling, to a position near the bell board, the continuity of the tube being broken for a few inches in each floor to allow of the wires from the points on each floor to be added. These tubes will be

of great service in forming conduits for the insulated wires; and a draw-wire must be left in each of the tubes, as already stated. The bell board is generally fixed in the passage leading to the servants' quarters. This position, in many cases, is not the most suitable for the indicator; but as all the existing tubes terminate at the bell board, it will be best to bring all the wires to this point, and then continue to the position selected for the indicator. For some points, especially on the ground floor, such as the entrances, housekeeper's room, servants' hall, and similar rooms, it may be found undesirable to use the existing tubes; and in these cases the wires must be protected with fresh tubes, or with casing and capping, painted to match the surroundings on completion of the work. In order not to damage the building more than necessary, it will be advisable to leave the bell board as fixed, removing all the carriages, cranks, check springs, etc., and painting it afterwards with the other woodwork. In running new wires, the best plan is to make a new track or run by boring a series of holes through the joists, about 3 in. down from the top. This method places the wires effectually out of the way of chance damage by floor brads or screws; and although it is not so essential to take this precaution in converting the crank to the electric system, as most of the old runs will be used, and the boards refixed by means of the same screws as previously employed, it is imperative to bore the joists when installing in a new building. The size of the holes will vary according to the number of wires, but ample room should always be provided, in order not to damage the insulating material on the wires. A $\frac{3}{8}$-in. hole should be the smallest made; this will carry four wires; a $\frac{1}{2}$-in. hole will carry seven wires, and so on in proportion. Assuming that all the old system has been removed, and the position for the indicator and battery decided upon, the wiring may be proceeded with. The wires used should be No. 18 gauge for the battery wire, coloured blue to enable it to be distinguished quickly when tapping on branches from the various points. The push or indicator wires should be not less than No. 20 gauge, and each of a different colour, so that they may be easily recognised when being connected to the indicator. The wires should be composed of well-tinned best quality copper, and covered with pure Para rubber in one continuous length, then double cotton covered, braided, and soaked in paraffin wax, or other preservative compound. The blue wire should be taken to the most distant push from the indicator, and a similar wire brought from every point and connected to the main wire. It is advisable to bring as many of these wires as convenient to one point, and connect them to the main wire in one joint. Care must be taken, however, not to make the connection unsightly by bringing too many wires to a single point. A No. 20 wire must be brought from each push point and carried to the indicator. The method usually adopted is to take one floor at a time for wiring. Having several coils of wire of various colours arranged in a central part of the building, take the blue, and one wire for each room, threading them through the holes made to receive them, and working towards the most distant point. As each position is approached, and where the indicator wire branches out from the main track, a blue wire must be carried along at the same time to the push point. When this is reached, a length of 6 in. of both wires is allowed to protrude from the fixing block. The blue branch wire is then cut sufficiently long to make a joint on the main wire. The same procedure takes place at each point, until all are completed upon the floor selected. The wires are then measured off of a sufficient length to reach the indicator and left ready to be drawn down with the wires from the floors above, unless a separate tube has been allowed for each floor previously, in which case the wires may be taken to the indicator, using the draw-wire left in the tube for this purpose. Fig. 311 shows the general run of the wires, the thick line representing the blue or battery wire; the method of running the branch wires to the pushes is also shown. The call wires are continued to the indicator from x. Having practically completed the wiring from each point to the indicator position, the blue wires should be connected together. In making the joints, remove the insulation



NOTE.—When possible, front and side views of the nails are shown.

5.

NAILS, BRADS, PINS AND TACKS COMMONLY USED.

for about 2 in. on the main wire. This may be done by cutting the outer braiding at the centre of the proposed joint, taking great care not to cut through to the copper wire; then warm the covering for a few inches to soften the compound, when the braiding can

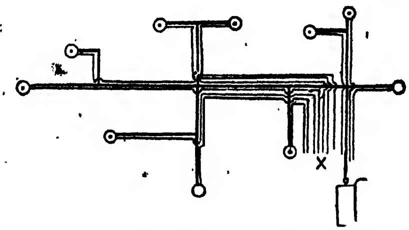


Fig. 311.—Wiring for Elaborate Electric Bell System.

be pushed back, leaving the lateral cotton covering exposed; this is removed entirely, leaving only the rubber insulation, which in turn is divided at the centre, and turned back towards the braiding. The end of the branch wire is treated in the same manner. Great care must be taken that the copper wire is not cut with the knife when preparing the joints, as even the smallest nick will be liable to start a fracture if the wire happens to be bent or worked at the point of damage. The branch wire is neatly wound round the main wire about four turns, and the superfluous portion removed, the end being cut with the pliers close to the main wire. A little resin having been first dusted on, the copper bit is held under the joint, and a strip of blowing metal applied to the top portion of the work; and as soon as the wire is sufficiently heated, the solder will flow. A knob of resin should be applied to the joint, to cause the metal to flow to every part. If too much solder has been applied, the wire may be given a sharp shake while the joint is still hot; this will remove any superfluous metal. As soon as the solder is set, the resin should be cleaned off with a wiper. The joint should now have a few layers of thin rubber tape wound carefully over the metal not covered by the existing rubber, the last lap being fixed with rubber solution. The braiding is next brought back over the insulation to its full extent, and the whole joint neatly covered with cotton the same colour as the braiding. The joint is then warmed by holding the copper bit or a spirit lamp underneath, and paraffin wax rubbed on the insulation until the whole is thoroughly impregnated. In insulating joints, rubber solution should be used very sparingly, and then only on the last lapping of rubber. When all branch joints are made, and before the pushes, indicator, battery, etc., are fixed, the wiring must be tested with a galvanometer and portable battery for "continuity" and "earths." The indicator must be firmly screwed to battens or hardwood plugs, projecting about ½ in. from the wall. In deciding the position, select a point as near the work as possible, preferably opposite a window, in order that the names of the various rooms written under the movements may be easily read by the attendants. The battery must be fixed in a dry, accessible position, and where extremes of temperature are not likely to occur. If possible, a point should be selected about 4 ft. from the floor, in order to facilitate cleaning, testing, and renewing. The cells should be enclosed in a small cupboard, or in a strong box having a movable lid and front. The holes left by the removal of the bell levers must be filled in flush with the wall by means of a wooden block screwed firmly to the old fixing block; this will facilitate the fixing of the special pattrass and push. To save damage, it is advisable to arrange the front entrance bell pull to ring the electric bells by means of a special contact (*see* Fig. 312). It will be noticed that the pull is connected by means of the ordinary copper bell wire to the eye of the con-

Fig. 312.—Special Contact for Front Entrance Bell Pull.

tact provided for the purpose, the handle portion of the bell pull being kept back to the plate by means of the spring. The stem is provided with an insulated bush to prevent short circuit when the pull is in its normal condition. When the pull is in

operation, the circular piece of metal makes contact with the spring terminals, thus completing the circuit. In some cases the front door pull can be altered to make electrical contact without the addition of the converter, as shown in Fig. 313. The front entrance is provided with a larger bell, or a movement having a wire gong, in order that a call may be attended to without referring to the indicator. The tradesmen's entrance is provided with a smaller circular or sheep-gong bell, and is usually fixed close to the kitchen. Neither of these bell points is shown on the indicator. In all the reception-rooms and principal bedrooms, one the latter fixed close to the indicator. Upon the bell ringing, the attendant lifts the instrument from the hook and speaks; the caller gives instructions, and the instrument is replaced. It is not possible for the attendant to call up any other instrument from the servants' quarters. Although all the principal points are prepared for telephones, it is not absolutely necessary for an instrument to be provided for each connection. Three or four portable instruments, according to the number of points, are generally sufficient for ordinary purposes. For the sake of economy, and to simplify matters, all the terminal contacts are made interchange-

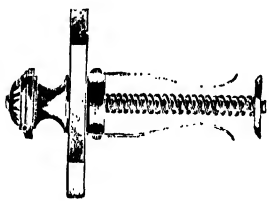


Fig. 313.

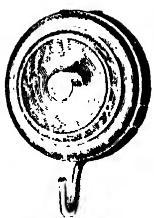


Fig. 314.

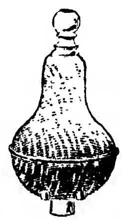


Fig. 315.

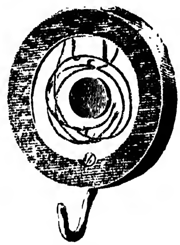


Fig. 316.

Fig. 313.—Bell Pull with Electrical Contacts. Fig. 314.—Combined Bell and Telephone Push. Fig. 315. Pear Push with Telephone Terminals. Fig. 316.—Back Block to Take Telephone Terminals.

or more points are provided with connections for the portable domestic telephone instruments. These special pushes are made in various forms. Fig. 314 shows the design of the push for fixing to the walls, and Fig. 315 the pear push or pressel arranged with telephone terminals. Where it is desired to fix metal and china pushes, a back block is made to take the telephone terminals, and is provided with connections for the push, as shown in Fig. 316. In cases where the plaster has been damaged or the edges of the paper torn in removing the existing bell pull, if back blocks are not used a wooden pattrass may be obtained, up to any reasonable diameter, and fixed over the damaged paper, prior to the fixing of the push. A variety of telephone instruments is available for use in connection with electric bells, but those illustrated by Figs. 317 and 318 are patterns generally in use, the former being used in the house, and able. The various connections of the system are shown in Fig. 319. This represents the installation having the instruments mentioned above. Many modifications may be made, and by means of a plug board fixed at the indicator two or more persons may converse, in which case the attendant can ring up any other number.

Troubles with Electric Bells.—If a bell does not ring satisfactorily, first see to the adjusting screw of the contact pin. Loosen this, and move it closer to the armature spring, or farther away, as may be required. If the spring is too stiff, bend it towards the armature a little. A pin that is very thin and sharp-pointed offers too much resistance, and must be blunted. See that all the connections between the ends of the wires and the screws or terminals are good and quite clean. The armature may seem to stick to the magnet cores when these are hard and thus retain magnetism after the

circuit is broken. To remedy this, either stick with gum or paste a bit of paper to the inside of the armature or to the core ends, or drill holes in them and insert two brass pins. If the poles of the indicator magnets, or those of the relays, are affected in a similar manner, adopt the same means to remedy the defect. If the clutch of a mechanical throw-back indicator holds the arm of the movement too tightly, it may be necessary to smooth the parts with a fine

Fig. 317.—Portable Telephone Instrument.

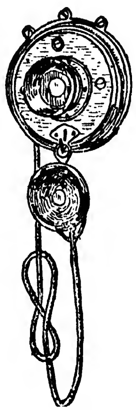


Fig. 318.—Fixed Telephone Instrument.

file until they work more freely. Attention must also be paid to connections here, as throughout the circuit these should be clean, and must not be loose. Similar attention must be given to relays and their adjustment. Electrical replacement indicators may give much trouble in adjustment before they work well; they should always be set true by the aid of a spirit level before the adjustment is made. Imperfect connections between the working parts of pushes, pressels, and pulls frequently cause bad performances in the bells and indicators, for a bit of dirt, grease, or grit between the contact surfaces will cause a break in the continuity of the circuit. Badly made pushes will corrode at the points of contact, especially in new houses and other damp situations. The springs of common pushes also lose their elasticity and get out of set. This is a trouble frequently met with in pulls, where it is liable to cause short circuit and a consequent continuous ringing of the bells. The connections may also be loose and corroded, the latter fault following the use of untinned copper wire, and of damp push blocks under the pushes. As faults are likely to be traceable to these points, they should receive first attention, and

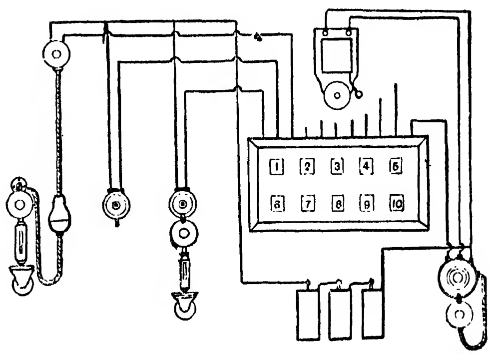


Fig. 319.—Connections for Combined Electric Bell and Telephone System.

the defects should be made good before seeking elsewhere on the circuit for flaws.

Electric Coil Making

The making of a small spark coil complete with condenser and discharger will now be thoroughly considered. Without here attempting to explain the scientific principles underlying the construction of induction coils, it will be described how to put those principles into practice by making a small coil capable of giving a short spark at the terminals of the secondary wire. As this small coil will in all probability be the counterpart of larger coils to be built later by the ambitious worker, the same care must be exercised in its construction as in that of its larger congeners, and its parts built up carefully piece by piece.

Bobbin for Small Spark Coil.—In the construction of bobbins for coils, the ends may be made of ebonite in best work, or of any good hard wood in more ordinary work. Boxwood is rather too brittle; holly and hornbeam are both good tough woods; both walnut and mahogany will serve the purpose, and also take a good polish. The bobbin ends for this small coil may be two discs of hard wood or ebonite $1\frac{1}{2}$ in. in diameter by $\frac{3}{8}$ in. in thickness. They may also be made square, hexagonal, or octagonal, as the shape will not affect the working of the coil; but they should be at least $1\frac{1}{2}$ in. across the widest part. When cut out and smoothed they should be, if of wood, immersed in hot melted paraffin wax and allowed to remain therein until the wax has well soaked into the pores of the wood, say for fifteen or twenty minutes. They should then be taken out and all the surplus wax rubbed off whilst still warm. A $\frac{5}{8}$-in. hole should now be cut in the centre of each end with a centre-bit to receive the tube and core to form the body of the coil, and two fine holes pierced through one of the ends near the centre hole to pass the ends of the primary wire through. The body of the bobbin may be of sheet ebonite $\frac{1}{16}$ in. thick, and 4 in. long, rolled into a tube $\frac{5}{8}$ in. in diameter, and glued into the holes in the bobbin ends. It may also be made of papier-mâché of the same thickness well soaked in paraffin, or a thin paper tube may be formed on a round ruler or glass rod, using thin glue to stick the sheets together; but it is advisable to soak this paper tube in melted paraffin before mounting it as a body of the bobbin. Coils have been made with plain wood heads merely polished and varnished, and tubes made of paper soaked in melted beeswax or coated with shellac varnish, but these do not equal paraffin as insulators.

Core of the Coil.—The coil bobbin may be made up in the following manner, beginning with the core of the coil, and this method is perhaps better than any other for building spark coils. First get a tube having a bore as large as the intended core of the coil—in this case $\frac{1}{2}$ in. in diameter—and pack the tube tightly with soft iron wires of No. 20 or No. 22 gauge cut to the length of the required core. This done, tie a piece of strong twine around the protruding end of the bundle and draw it out of the tube whilst winding the twine tightly round it. After this, immerse the bundle of wires in melted paraffin, let it soak therein for a quarter of an hour, then set it up on end to drain and cool. Meanwhile, get some wide tape and soak in the paraffin. Unwind the twine from the core of wires and wind on the paraffined tape until the bundle has been smoothly covered with tape. The ends of the bundle should now be dipped into some good glue and fitted tightly into the bobbin ends, leaving one end of the bundle protruding from one of the ends about $\frac{3}{8}$ in. or $\frac{1}{2}$ in. to form a pole of the magnetic core. When the glue has set and the ends are quite firm, get a strip of strong thin paper soaked in melted paraffin, and envelop the core with two or three layers of this before winding on the primary wire. When coils are built up in this manner, there will be no power lost between primary and core, either by bad insulation or over-insulation. Some writers on this subject recommend the ends of the core to be capped with thin iron caps soldered to the ends of the core before soaking in paraffin. This makes the ends compact, but is open to the objections of weakening inductive effects, and liability to retardation of magnetic effects through the use of hard iron. If the ends of the wires forming the core are neatly trimmed to form a smooth end opposite the break, this will be all that is necessary.

Primary Wire.—The primary wire for this small coil may be of No. 20 or of No. 18 silk-covered copper wire. Pierce a small hole with a fine bradawl through one of the bobbin ends down near the body of the bobbin, and pass one end of the primary wire, to the length of 5 in., through this hole from the inside, then wind on the wire until the tube has been covered with four layers of the wire. Leave 8 in. of the back end free, and pass this out through another small hole made in the same bobbin end as the first. These two wire ends will be used for connecting the coil with the battery, and directions will be given for this further on; at present, coil both of them into spirals around a pencil to keep them out of harm's

way, and leave them as two small curls at one end of the bobbin. Before winding on the wire, it will be advisable to see that it is properly covered with silk and to make good any defects observable; while, to make sure of the insulation, it will be advisable to run the wire through some melted paraffin. Now, after winding the coil, it will still further improve the insulation to baste the primary with the hot wax whilst holding it over the vessel in which the wax is melting. Then have some strips of thin strong paper, soak them in paraffin, and envelop the primary with two or three layers of this paper, smoothing all well into a compact coating. This is specially advisable in building the primary of larger coils.

Secondary Wire of Coil.—The secondary wire of a spark coil must be of soft copper, and should not be of a larger gauge than No. 36 Birmingham wire gauge. It may be of No. 40 with advantage in this small coil, especially if No. 20 be used as a primary wire. It must be continuous throughout the whole length to be employed in the coil (4 oz. of No. 40, or 6 oz. of No. 36, will be needed for this coil), and free from kinks. To test its continuity, it will be advisable carefully to unwind it from the bobbin on which it is wound when purchased, and to wind it on another bobbin mounted on a metal spindle. Pass the commencing end of the wire through a hole in one of the bobbin ends and clean off the silk covering, then twist the end of the wire around the spindle. Have the galvanometer on the bench, and also a battery of one or two cells, any kind will do; wind the wire from one bobbin to another slowly, and keep a sharp look-out for knots and bare uncovered spots. Should one of the first appear, unfasten it, and test the continuity of the wire by connecting it in circuit with the battery and galvanometer in this way: connect a wire from the battery to the bobbin spindle, the other wire being connected to the galvanometer, then touch the opposite galvanometer stud with the end of the unfastened wire; if the needle moves, the wire is continuous so far, and the knot must be remade by baring the ends, cleaning them, twisting $\frac{1}{2}$ in. of the ends together in the form of a long splice, and tinning the splice with a little solder. The uncovered spot must now be made good with a thread of soft silk wound around the joint to fully cover it. Uncovered spots must be tested in a similar manner by touching them with a wire connected to the galvanometer, and then coating them with silk. If the needle does not move, there is a bad joint or a break in the wire, and search must be made until the fault is found. Sometimes the copper wire is broken, only the silk covering holding the parts together. Sometimes the wire has been broken and a knot tied with the covered wire. These faults must be made good, and then, when a movement of the galvanometer needle shows that the wire is continuous throughout, the wire should be run back through melted paraffin, kept hot in a pie-dish by a kind of glue-pot arrangement with hot water in an outer dish. If a small pulley, such as a blind-cord pulley, is put on a piece of bent wire, the covered wire may be run under this whilst held in the hot paraffin, and thus all danger of abrading the silk covering may be avoided.

Winding Secondary Wire.—The secondary wire may now be wound on the primary whilst the bobbin is being revolved in a lathe or similar machine for producing rotary motion. (Coil winders are specially made for the purpose.) Wind on the secondary wire in the same direction as the primary, having first coated this with two or three layers of paraffined paper. Run the bobbin containing the wire loosely on a round steel or iron spike held in the left hand or fixed on a support at a little distance from the lathe. Pass 8 in. of the first end out through a hole in the coil bobbin end, and coil it in the form of a helix. Revolve the lathe slowly, and guide the wire on by hand. If the hand is held some eight or ten inches away from the coil, and allowed to follow the wire, this will run on evenly in turns side by side, as if guiding itself. Some coil makers prefer a turn of foreign post paper soaked in paraffin between each layer of secondary wire; to this there is no objection, providing only one turn is used, as it helps the beginner in winding the next layer. Hot melted paraffin wax may be basted on instead, if preferred. Layer after layer must be

thus run on regularly side by side and over each other until all the wire has been used. The commencing end of the wire, coiled up as a helix at one end of the bobbin,

Fig. 320.

Fig. 321.

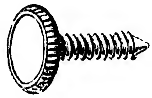


Fig. 322.

Fig. 323.

Fig. 325.

Fig. 320.—Break Spring and Hammer of Coil.
Fig. 321.—Break Pillar, Collar, and Nut of Coil.
Fig. 322.—Platinum-tipped Contact Screw.
Fig. 323. Terminal Binding Screw, Nut, and Collar of Coil.
Fig. 325.—Terminal for Secondary Coil.

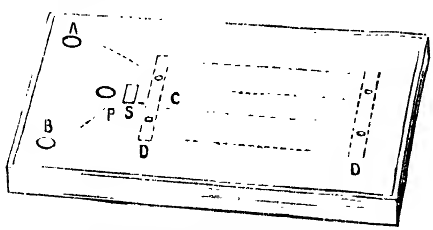


Fig. 324.—Baseboard for Coil.

may now be carefully straightened out, and led in a fine saw-cut up to the top of the bobbin, where it should be soldered to the foot of a small brass pillar to form one terminal of the secondary. The other end of the secondary must be taken to the opposite bobbin end, and there secured to another pillar. These parts will be described further on. The whole bobbin between the ends may now be coated with a piece of silk or a piece of fancy leather bound tight down over the wire, and secured to the underside by a lacing of silk cord. This gives the coil a finished appearance, and it may now be fastened down to the base or stand (made of polished walnut or mahogany, 7 in. by 4 in. by $\frac{3}{4}$ in.) by four brass screws passing up through the base—two at each end—into the wooden ends of the bobbin.

Automatic Interrupter or Break.—When the coil is fixed down to its stand or base, measure the distance from the top of the core to the base of the coil, and cut off a piece of thin sheet brass or German silver $\frac{1}{2}$ in. longer than this to serve as the break spring. That will be, in a coil of $1\frac{1}{2}$ in. in diameter, a strip of spring brass or of spring German silver $1\frac{1}{4}$ in. in length by $\frac{3}{8}$ in. in width. This should not be too stiff, or it will vibrate too quickly for a spark coil. Round one end, smooth the edges, and bend $\frac{3}{8}$ in. of the other end to form a foot for the spring. In this, drill two small holes for two brass screws. At a spot in the rounded end, exactly opposite the centre of the core when the spring is fastened down in place, drill another $\frac{1}{8}$-in. hole to receive the tang of the break hammer. The hammer must be of soft iron with a face of the same diameter as that of the core, and from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. in thickness. The head of a large iron clout nail will do for a small coil. The hammer may be riveted or soldered to the spring as may be deemed convenient. On the opposite side, at the back of the break spring, must be soldered a speck of rather thick platinum foil. This spring (Fig. 320) may now be fixed to the base of the coil with the hammer face at the distance of $\frac{1}{4}$ in. from the face of the core end, one end of the primary wire being secured under the foot of the spring, or soldered to it before fixing it in its place. The other end of the primary wire will go to a terminal binding screw on the baseboard. The break pillar shown at Fig. 321 is merely a piece of $\frac{3}{8}$-in. brass rod 2 in. in length, turned to the form shown in the figure. In the upper part, opposite the speck of platinum on the break spring, drill and tap a $\frac{1}{8}$-in. hole to receive a brass screw $\frac{3}{4}$ in. in length,

having a milled head (Fig. 322). The end of this screw must be tipped with platinum wire soldered into a slot cut in the end of the screw. This is named the contact screw. The lower part of the pillar should be turned down to $\frac{3}{16}$ in., and a thread cut on $\frac{1}{2}$ in. of this to receive a nut. This part of the pillar will pass through a hole in the baseboard, and the end of a short piece of No. 16 wire will be clipped between the nut and a brass collar to connect the pillar with a terminal binding screw on the base of the coil. These screws are shown at Fig. 323.

Fixing Parts of Coil.—Fig. 324 shows a plan of the base of the coil, and indicates the position of its various parts. The bobbin should be fastened down to the base, midway between the two sides, and with its back end 1 in. from the edge of the baseboard. The spring of the break should be fastened down to the base so as to bring the hammer face $\frac{1}{4}$ in. from the end of the core. The break pillar must be fixed near enough to the spring to allow its platinum-tipped screw just to touch the spring when the screw is half-way into the pillar. This will allow room for adjustment both ways. The screw should be furnished with a lock-nut to keep it from getting loose. The two terminal binding screws for the ends of the primary wire will be screwed into the base at the two corners, as marked A and B in Fig. 324. One end of the primary wire will be fastened to the foot of the break spring. From the foot of the break pillar, beneath the base, a short piece of No. 16 wire will connect this with one of the terminal binding screws, as shown by the dotted line from B to P. The other end of the primary will pass down through the base of the coil and be carried under to the terminal binding screw A. The terminal for the secondary coil is shown by Fig. 325.

Testing Coil.—Now test the coil by connecting a one-pint bichromate or chromic acid cell to the terminal screws. Adjust the contact screw until a steady to and fro motion has been obtained, then span the terminals of the secondary with a piece of wire and note the spark. This will not exceed $\frac{1}{8}$ in., but the length will be increased after a condenser is added. The terminals may also be spanned with the finger and thumb of one hand if the maker cares to test its stinging shock. Its efficiency as a spark coil will be increased by the use of a condenser and spark dischargers, described below.

Length and Strength of Spark.—On starting the small coil (made as above described), and connecting the two terminals of the secondary coil by bridging the two with a piece of No. 8 copper wire, a short thin spark will be seen to play between the end of the stout wire and the screw of the terminal. This spark will not satisfy the maker of the coil, who will expect to see one quite $\frac{1}{4}$ in. long—that is to say, on first connecting the wire with the terminal, and then gradually slipping the end of it off, he will expect to see a spark follow the end of the wire when this is quite $\frac{1}{4}$ in. off from the terminal. The shortness of the spark may be due to bad insulation of the wire (there may be no spark at all if there is any defect in the wire), or the break may not work right, or the battery may not be in good order. If a one-pint cell does not work the coil, try two such cells in series, but no more for such a small coil. If too many cells are employed in trying to lengthen the spark of a defective coil, the defect will be intensified, because the tension of the induced current will then be raised, and it will break down the already defective insulation of the coil. But suppose the insulation and continuity of the wire coils to be perfect, and the right battery power employed, and the break or interrupter in working order, the spark will still be shorter than was anticipated. The cause lies in the fact that the primary current passing through the primary coil is subject to a serious hindrance, arising out of the self-induction of the current. At the instant when the current is interrupted it charges the primary coil with electric energy, and this is discharged against the current when the primary circuit is restored. In this battle much energy is lost which might be transmitted to the secondary coil. There is therefore needed some addition to the coil: something to absorb the back-lash of the current: something to act as a thrust-block or buffer to this opposing force. This addition is named a condenser, and is described on the next page.

Condenser. This is a storage chamber for the extra current set up in the primary coil by self-induction. The inductive charge of the coil is sent into this chamber instead of being allowed to rush back on the primary current, and from this is discharged in the same direction as the primary current when the circuit is restored. The baseboard of spark coils is made in the form of a shallow box to form a condensing chamber beneath the coil, or a space is hollowed out in the baseboard to receive the condenser. The chamber itself is only a receptacle for the condenser, which is them aside as cut. If the condenser is to be used for a large coil it will also be advisable to cut a number of small strips of tinfoil, ¾ in. in width by 2 in. in length (an equal number to that of the sheets of tinfoil), to be laid on the ends of the sheets (as shown by Fig. 326) to form connecting lugs. The same arrangement may be made for the condenser of a small coil; but this is not usually done, connection being made with the overlapping ends of tinfoil. The sheets of tinfoil will have to be built up into the form of a block or book, with a sheet of waxed paper between each two sheets of tinfoil.

Fig. 326.

Fig. 327.

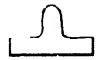


Fig. 328.

Fig. 331.

Fig. 332.

Fig. 333.

Fig. 326.—Tinfoil Sheet and Lug for Coil Condenser. Fig. 327.—Construction of Coil Condenser.
Fig. 328. Brass Lug. Fig. 331. Socket for Foot of Discharger Pillar.
Fig. 332.—Brass T-piece. Fig. 333.—T-piece with Set-screw.

Fig. 329. Tape-bound Condenser for Coil.

Fig. 334.—Discharger Handle and Rod.

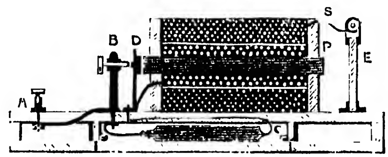


Fig. 330.—Section of Induction Coil.

made up of a number of sheets of tinfoil, insulated from each other by sheets of waxed paper, but connected alternately at the ends. These sheets receive the extra current from the primary coil, and then give it back again to the primary circuit. First determine the area of the condenser and the number of sheets to be employed in it, such being arranged to suit the size of coil. For small coils to give ⅛-in. spark, there will be required 25 sheets of tinfoil, 2 in. in length by 1 in. in width; for a ¼-in. spark, use 10 sheets of tinfoil, having an area of 2 in. by 1½ in.; for a ½ in. spark, use 50 sheets, 2 in. by 2 in.; for a ¾-in. spark, use 60 sheets of 1 in. by 1 in. The tinfoil must be quite smooth, and free from holes and cracks. Cut the tinfoil in strips of the required size (using a sharp knife and a straightedge on a smooth board or sheet of glass), and lay The paper selected for this purpose must be thin and tough, and free from glaze, size, or salt of any kind. It must be smooth, and quite free from cracks, flaws, and pinholes. As each sheet is cut, it should be held up to a strong light, and thus examined for flaws. For condensers with overlapping sheets of tinfoil, cut the sheets of paper 1 in. wider than the sheets of tinfoil, so as to have ½ in. of paper on each side of the foil; but for larger condensers with connecting lugs, allow 1 in. of paper all around each sheet of tinfoil. When all the sheets have been cut, examined, and selected, put the perfect sheets in a shallow dish (such as a baking-dish) one at a time, with a few shavings of paraffin wax on each sheet; then put the dish in a moderately heated oven until the paper floats in melted paraffin. Paraffin wax varies in quality; the best for this purpose is a hard, dense white

substance, resembling white wax of best quality. If a choice can be had, choose this in preference to that having a yellowish tint and a soft, crumbly appearance. When the paper has been well soaked in the melted paraffin, take up each sheet with a pair of forceps by one corner, allow the hot paraffin to drain off, then place each sheet separately on a clean board to get hard. This will only take a few minutes, as the wax will harden almost immediately. The tinfoil and sheets of insulating paper are now ready to be built up in the form of a book. The covers of this "book" will be of wood. Get two pieces of thin mahogany or similar hard wood, ¼ in. less in length and breadth than the paper insulators of the condenser. These must be well smoothed and varnished on both sides. Lay two sheets of paraffined paper on one of these boards, then a sheet of tinfoil (*a*), with one end overlapping one end of the paper for ½ in. (*see* Fig. 327) On this lay another sheet of paper (*c*), exactly coincident with the lower sheets; then lay another sheet of tinfoil on this, with the opposite end overlapping the paper to the length of ½ in. Thus go on building up the pile with alternate sheets of paper and tinfoil, each alternate sheet of tinfoil overlapping the paper to the left, and each other sheet overlapping the paper to the right (as shown in the diagram, Fig. 327). If the condenser is for a large coil, this arrangement may be modified by placing all the sheets of tinfoil coincident with each other, and placing on each sheet alternately, right and left, the small strips of tinfoil cut for the purpose to form lugs. When the pile is complete, put on the top board or cover, and apply pressure to the whole pile to the extent of several hundredweights, applied gradually, so as to compress the whole firmly together. This done, bind the whole bundle tightly together with broad tape, wound around across its breadth. All the projecting pieces of tinfoil at one end must now be soldered together, and those at the other end of the pile must be similarly connected to form connecting lugs for the wires from the coils. The best method of doing this is as follows. Get a thin piece of sheet brass or thin copper sheet, and cut out two pieces of the form of Fig. 328. Clean and tin both sides of the widest parts, place them in between the projecting pieces of tinfoil, so as to have half on one side and half on the other, then lightly solder them on both sides to the connecting strips. Binding screws may now be soldered to the strips for convenience in connecting these to the coil wires (as shown at Fig. 329). The condenser will be placed in the cavity beneath the coil, and its two ends will be connected by short wires to the contact pillar and break-spring of the coil, so as to form a connecting link between them. Thus, a wire will go from the foot of the contact pillar B to one of the terminals on the condenser C, and another wire will go from the opposite end of the

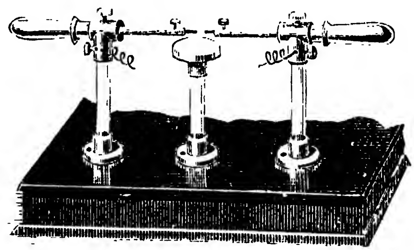


Fig. 335.—Discharger, with Ebonite Table, for Induction Coil.

condenser to the foot of the break-spring D (as shown in the section, Fig. 330). The extra current of the primary P (which gives a smart spark at the tip of the contact screw) will now pass into the condenser, and the length of spark will be lessened at the point of contact. A (Fig. 330) shows binding post terminal; E, discharger pillar; and S, secondary wire.

Discharger.—In making a small spark coil with moderately thick bobbin ends, mount a small binding post on the ends, and connect the ends of the secondary coil to these. In the holes on the upper part of the posts insert two stout brass wires, and slide these in the holes until the tips are near enough for the sparks to pass. If the brass wires of this improvised discharger are furnished with small handles of hard wood or of ebonite, they may be worked without feeling a shock; otherwise the operator will get a twofold result from his coil, one of

which will be unpleasant. If square ends are employed to the bobbins, both ends of the secondary wire may be brought to small posts at one end of the coil. Such an arrangement would be inconvenient with a large coil, and might also be dangerous to coil and operator alike. It is therefore desirable to have the discharger as a separate piece of apparatus. Therefore get or make brass sockets, with foot flanges (shaped as shown at Fig. 331), and large enough to hold a ¾-in. or ½-in. glass rod. Fix the sockets 3 in. apart on the baseboard of the coil, at the opposite end to that of the contact breaker, and cement into each a 3-in. length of glass rod or ebonite rod. Next get two T-sockets (shaped as shown at Fig. 332), the upright branch of each to fit the tops of the glass pillars, and the horizontal tube on top to fit the sliding bars of the dischargers. These may therefore be ⅜ in. or ¼ in. Each tube should also be furnished with a set-screw in the side, as shown in Fig. 333, to hold the discharger in position, and another set-screw and hole to receive the ends of the secondary wires. Cement these T's to the tops of the pillars, taking care to have the tubes on top in line with each other. Now get two 4-in. lengths of brass or copper rod exactly to fit the tubes. At one end of each, fit a small handle of ebonite, or baked hard wood soaked in melted paraffin. In the opposite end of each rod drill a $\frac{1}{16}$-in. hole to the depth of ¾ in., and drill a ⅛-in. hole to intersect this hole half-way. Tap this hole for a screw, and fit to it a short set-screw with a milled head (Fig. 334). These holes will be employed to hold bits of wire used in experiments with the coil. Midway between the pillars of the discharger fix another insulated pillar, capped with a small table of ebonite. This will be found useful to hold substances subjected to experiments with the coil, as the chosen substance can be placed on the small table whilst the sparks are sent through it (*see* Fig. 335).

Using Discharger. Connect the secondary wires to the T-sockets on the discharger pillars, or, if the ends of the secondary wires are already connected to brass terminals, lead wires from these to the T's on the pillars. Hold one of the discharging rods by the insulated handle, and slide it through one of the T's half-way, then fix it there. Take the other rod by the insulated handle, and slide this through the other T until the tips of the two rods are near enough to allow the charge of the secondary to discharge itself between them. If one of the sliding-rods is graduated in parts of an inch, the exact length of the spark can be ascertained at once. The tips of the rods should be first fitted with bits of platinum wire—these are the permanent discharging points—but may afterwards be replaced with bits of other wire with varying and pleasing results. In making a discharger for a large coil, the various parts should be enlarged to match the coil, and a ball and socket T will be found to be a convenience instead of a fixed T on top of the discharger pillar. In this all joints must be well fitted, to prevent corrosion by sparking.

Electro-plate (*see* Silver)

Embossing (*see* Acid)

Emdeca (*see* Wallpaper)

Enamelled Bath, Cleaning (*see* Bath)

Enamelled Utensils, Repairing

Holes in enamelled-iron utensils may be easily repaired by using ordinary soft-iron tinned rivets or copper rivets and washers. It is better, however, to ream out the hole the full size of the rivet and set the rivet up tight without hammering, as by placing it in a vice and screwing up the jaws. This does not crack the enamel around the hole.

Enamelling

Enamelling Cycle with Air-drying Enamel.—The following directions will, if carried out, produce a highly polished coat of japan on a cycle. Begin by taking the machine to pieces, removing both wheels, the chain, handle-bars, and saddle pillar; it is well to remove the cranks, spindle, chain-wheel, front forks, and back stays, but this is not absolutely necessary. Then remove all the old enamel, either by burning and scraping, or scraping only. Care must be taken when burning the enamel around the top and bottom of the head and the bottom bracket, as the heat might lower the temper of the

hardened steel bearing cups fixed in these parts. The work must next be thoroughly cleaned with emery cloth, and afterwards with a little pumice powder and water on a clean rag. Clean cloths should be used when the work has to be handled, and lifting should be done by wooden pegs driven fairly tight into the down tube and head of the frame; touching the frame with the bare hand must be avoided after cleaning. Screw threads that are to be free from enamel may be covered with string, and holes filled with cork or wood plugs. Use good quality quick-drying enamel and a flat camel-hair brush, and give every part of the frame a thin coat of enamel, working in one direction only, and getting as even a surface as possible, to save labour in future rubbing down. Then put the frame to dry in another room free from dust, placing it upside down, so that it rests on the back fork ends and the peg in the seat tube. Any dust will then fall on parts that are out of sight. After this coat is dry (in not less than twelve hours), rub down with a bit of well-worn glasspaper. Now remove any dust, and apply the second and third coats of enamel, letting the second dry, and rubbing down before applying the third. It is better to give the last coat twenty-four hours to harden, as it may be rubbed off in the subsequent operations if it is at all soft. For the rubbing down or surfacing process, a little of the finest sifted, powdered pumicestone (surfacing powder), procurable at any paint or oil shop, will be wanted. Wet the surface of the enamel with a little cold water, take a piece of soft flannel, moisten it with water, and dip it into the pumice powder, and, with this, rub gently. From time to time examine progress, washing off the powder with a sponge or flannel and water, and drying with a soft cloth. If necessary, resume the rubbing as before, until the surface presents a dull and smooth appearance, no shining spots being left. Now wash off every trace of the surfacing powder, and dry the surface. Next slightly moisten a piece of the softest flannel with olive oil, then dip it into rottenstone or tripoli powder (moisten the surface to be polished with a slight touch of oil), and rub with light strokes until the polished surface appears. When all the tubes have been done, remove the oil and rottenstone with a bit of soft cotton rag, and the last traces of oil with a soft cloth; afterwards rub very lightly with dry rottenstone on a piece of silk, preferably from an umbrella, and finally with the silk alone. In all the work, keep everything free from smoke and dust. As a cheap substitute for the pumice powder mentioned above, necessitating, however, a fourth coat of enamel, use ordinary washing soda that has been kept some time. This should present a white, floury appearance, and any hard transparent lumps in it should be removed. It should not be used if the proper powder can be obtained.

Stove-enamelling Cycles.—The size of the stove varies according to the number of goods to be handled. For small quantities, there are several good types of sheet-iron stoves obtainable; but for large quantities a brick and iron structure should be built. Those heated by gas are cleaner, and more economical. The burners should be separated from the drying chamber with a false bottom of good thickness, and should be perfectly sound in construction, so that there is no risk of gas fumes mingling with the vapours arising from the enamel. The drying chamber must be ventilated by having one or more small holes near the bottom, and another with a pipe attached leading from the back (near the top) for the purpose of carrying away the fumes. If these are so arranged that no draught is created, drying of the enamel is thereby hastened. The heating arrangement should not be a central one, but should be supplied by a pipe running along the front, with three branches extending to the back, each branch quite independent of the other, so that the heat can be the better regulated. Atmospheric burners, to give a blue flame, should be used, in preference to ordinary burners, thus ensuring freedom from smoke. A thermometer graduated to 400° F. should be fixed inside the stove. The application of enamel for stove-drying purposes differs somewhat from the method adopted for air-drying. No time should be lost in taking the work in hand after it is cleaned up. The first stage is known as sweating. A

clean rag is dipped in tar spirit, then squeezed out, and every part of the goods well rubbed. Place them in the stove, and turn on the full heat, 350° F., for about twenty minutes. When quite cold again, apply the first coating by means of a flat camel-hair brush, laying it on as thin and even as possible, working from end to end. Then put it in the stove for about an hour, and bring up gradually to full heat. When cold, the enamel surface should be smoothed down with pumice-stone and water, and wiped quite clean and dry. Apply the second coating, using a finishing enamel, which is somewhat different from the first coating. Suspend in the stove, and bring up to full heat at once, testing at times, till the enamel is dry, with just a suspicion of tackiness whilst hot; then turn out the gas, or remove the goods from the stove. The enamel will be perfectly hard when cold. If dried thoroughly hard by high heat, the enamel becomes brittle, and may easily chip. The length of exposure to high heat varies; an hour may suffice for some enamels, while others may require one and a half hours. It should be pointed out that the wheels are not usually done with the frames, a special preparation for the wheels giving good results with only one application. For ordinary purposes, two coatings on the frames and one on the wheels, independent of the sweating, give good medium quality results. High-grade goods require another dulling down and an extra coating of finishing enamel. The enamel surface is brought to a high degree of finish by first removing the glazed surface with white rottenstone and water, then bringing up the lustre with black rottenstone applied on the palm of clean, soft hands. The makers of enamel will generally state at what heat their goods will give best results; the requisite length of exposure must be determined by experiment.

White-enamelling Furniture.—The white enamel finish on furniture will give good wearing results only when started direct from the bare wood. Consequently, it will be useless to attempt this mode of finish on goods that have been already polished unless the surface has been thoroughly cleaned, either by the aid of scrapers or a good polish solvent. Furniture that is finished in self-colour enamels is generally of quaint but simple design, the sameness of colour being sometimes relieved by suitable decorative designs in subdued colourings. The enamel surface may be worked up to several degrees of finish, according to the class of goods. High-grade work is finished in oil enamel, which costs about 20s. per gallon, whilst the cheaper grades are finished by a combination of french-polishing and spirit varnish. In either case, the foundation colour and finishing coats should be laid on with brushes that have been previously used on other work. If new brushes are used, there is great risk of trouble through the shedding of bristles or hairs, or the surface may be spoiled by brush marks. For a spirit varnish or french-polish finish, proceed as follows: Mix gilder's washed whiting in a warm solution of double size, and apply like paint. When dry, remove any apparent roughness by glasspapering; then apply a second coating. This, when dry, must be smoothed down with a felt-covered rubber and pumice-stone powder. Then dissolve 2 oz. of isinglass in 1 pt. of water, and stir in 3 oz. of flake-white. Apply as hot as possible, but avoid working it about so much as to break up the size foundation. If necessary, cut down smooth with felt and pumice, and repeat the process as often as may be required to gain a solid white surface. When dry, apply white or transparent polish, dipping the rubber occasionally into some flake-white before enclosing it in the rag covering. On some kinds of wood it will be found serviceable to apply one or more coats of white hard spirit varnish, to assist in gaining a good body more quickly. For this purpose, mix flake-white in the varnish also. A good body of polish, or combination of polish and varnish, having been built up, and due allowance made for its sinking and hardening, it can be finished off the same as any ordinary polished surface. High-grade finish is worked up by a process more akin to house-painters' work. Soft varieties of wood are coated with size and whiting or a good brand of grain filler. Several applications of white paint are then given. The paint used does not

contain much oil, preference being given to the addition of varnish to act as a binder. As each coat dries, it is smoothed down with pumice till a surface is built up perfectly smooth and free from scratches. For white Coburg, white enamel varnish

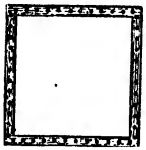


Fig. 336.—Frame for Oil Filter.

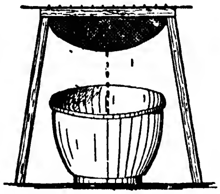


Fig. 337.—Simple Oil Filter.

is used, or the finest brand of copal varnish, tinted by adding flake-white, as supplied in tubes, two coats of this being given. If the garish appearance of the varnish is objected to, it may be polished by hand, or the polishing may even be omitted, if this is preferred. The work of enamelling may, however, be much simplified by the use of specially prepared enamels, laid on the foundation of double size and washed whiting. These enamels, though rather expensive, give excellent results, among them being Albarine, Ripon, and Ripolin. Flake-white, which is sometimes called zinc-white, gives far better results for this purpose than white-lead.

Engine

Cleaning Rusty Engine.—The only satisfactory method of cleaning an engine that has got thoroughly rusty is to scour all the parts that were originally bright. To do this it will be necessary to strip the engine, but before doing so the whole of the engine should be coated several times with petroleum oil; this will soften the rust and allow of the nuts and pins being moved. The engine is then thoroughly wiped with waste to remove as much of the rust as possible. The flat surfaces are polished with emery-cloth and oil, the cloth being glued on flat boards and used as a file; use cloth of varying degrees of coarseness, commencing with the very coarse and finishing with the finest. To polish the round parts, emery powder mixed with oil is used, the paste being smeared on a flat rope, made by plaiting together several strands of cocoanut fibre. The polishing is done by twisting the rope twice round the rod to be polished, and drawing it backwards and forwards, using emery powder of varying grades, finishing with the finest. Each part as it is polished is painted with white-lead and tallow to prevent rusting again. The brass surfaces can be polished with any good metal polish. Bolts, nuts and pins might be replaced with new, as this will be cheaper than cleaning the old ones. After re-erecting the engine, go over it (if it is not to be used at once) with white-lead and oil.

Recovering Engine Oil.—Engine oil can be purified by filtration so that it may be used over again. For this purpose, first filter it from the black sediment by means of a cotton cloth, and then finish by passing it through filter-paper. Construct a strong frame of wood about 1 ft. square (as Fig. 336), and along each side of the square drive in about 1 dozen tacks long enough to pass through the wood so that their points appear. Now get a square of cotton cloth and fix it upon the points of the tacks, and then place the frame over a basin. Pour the dirty oil on to the cloth, and in a short time the clear oil will begin to run through (Fig. 337). This filter may be kept going continuously until the oil ceases to drip, after which the cloth must be thrown away and a clean one put on. If the oil does not appear quite bright, take a square of blotting-paper, double it twice, and cut out a quarter circle

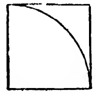


Fig. 338.

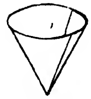


Fig. 339.

Figs. 338 and 339.—Filter-paper.

Fig. 340.—Oil Filter for Second Filtering.

from point to point (Fig. 338); open it out on the one side (Fig. 339) and place it in a glass or tinplate funnel, then pour on this the oil from the previous filtration. Allow it to run into a bottle (Fig. 340), and probably

it will then be quite as clear as the original oil. The two sets of filtrations may be carried on continuously, pouring in a little oil each day; never mind if the filtration goes on slowly, the oil will be clearer than it would be if it ran quickly. Do not pour the dirty oil directly on to the filter-paper, as it will rapidly choke it.

Engraved Plates, Filling

(1) A cheap wax filling for small brass plates is shoemaker's heelball, used plentifully. Warm the plates and rub the heelball well into the cuts, scraping off the superabundant heelball with the straight edge of a card, and put the plates aside to harden. Then polish off with a piece of coarse flannel and a drop or two of oil. (2) Another filling is best black sealing-wax, ground up fine and placed in the cuts, filling them well up to the surface of the plate and then pressing down, taking care that very little of the powdered wax is left upon the surface of the plate. Then the plate is gradually warmed until the wax in the whole of the work is melted, then placed aside to get cool, rubbed with a Tam-o'-Shanter hone to remove any wax left on the surface of the plate, and polished with flannel and oil. (3) Some engravers prefer grinding up their sealing-wax with gold size, then filling the work, putting it away to set, and cleaning off with alcohol or spirit of wine. This composition requires time to harden, and sets bright. (4) Dissolve enough best black or red sealing-wax in alcohol to make a thick solution of the texture of thick cream, and fill the engraved lines with it; when the alcohol is evaporated the solution will gradually harden. Finish as above. (5) A solution made in the same way as No. 4, but considerably thinner, is a good filling for xylonite, ivory, and pearl, filling the cuts, and letting the solution harden for twelve hours, then "dollying" off with a small quantity of whiting in a lathe. (6) In dealing with red and other wax of a light colour, the greatest cleanliness must be observed as, for instance, instead of holding the plate over the flame of a gas jet, it is much better to use a gas stove, thus obviating smoke. Then grind up the wax very fine, fill the lettering, warm the plate to the melting-point of the wax, and press into the cuts with a clean, cold, flat piece of iron. Then rub off the greater surface of the wax with a rasp, taking care not to scratch the surface of the plate; follow with pumicestone ground flat, and finish with a Tam-o'-Shanter hone. The polishing can be done with rottenstone, jeweller's rouge, and common oil mixed together to form a red liquid, using two or three folds of thick cloth wrapped round a large piece of cork or wood as a rubber. As the brilliancy of the red depends greatly on the quality of the wax, it is advisable to procure the best.

Engravings (*see* Prints)

Etching

Etching Aluminium (*see* Aluminium).

Etching Brass.—Engraving with the aid of acids is termed etching, and is thus distinguished from engraving by hand. In etching, the metal is covered with a ground or resist, the characters scratched with a style, and the metal immersed in acid until etched sufficiently. Black japan and Brunswick black (commercial), which can be obtained at a druggist's, may be recommended as a ground or resist; or Rhind's Etching Ground, which is obtainable of first-class artists' colourmen, can be used. The strength of the acid (nitric) should be half water and half acid; but the heat of the room should be taken into consideration, as the acid will act quickly in a warm room. Take a sheet of brass that has been hammered flat and polished on the face, cover it on the face, back, and edges, with a thin coat of Rhind's Etching Ground, and allow to set. Draw the design with a pencil, and scratch through the pencil lines with a moderately sharp etching needle, removing with a small brush all chips of etching ground as fast as they are thrown up. Provide a porcelain bath a few inches deep and large enough to contain the plate; then place in the bath equal quantities by measure or weight of nitric acid and water. Then immerse the plate in the bath, and if the action is too violent, add more water; and if too mild, add more acid. When a gentle ebullition is set up, the acid is acting normally.

When the etching is apparently deep enough, take out the plate, wash in clean water, and examine for depth; if not deep enough, return to the bath. The resist may be cleaned off the plate with hot soda and water and a stiff brush, or by soaking for an hour or so in paraffin. Those parts of the etching that have roughened and irregular edges will require retouching with a graver, as the tendency of deep etching is to undercut the work and spread in the direction of the deepest portions.

Etching Fluids for Various Metals.—The fluids employed in etching designs vary considerably, every workman having his own recipes. Some of them are as follows: For etching on copper and brass: (*a*) Nitric acid $2\frac{1}{2}$ oz., water 5 oz.; mix. (*b*) Sal-ammoniac, sea salt, and verdigris, each 4 oz., vinegar 8 oz., and water 16 oz.; boil for one or two minutes in a glazed vessel, cool, and decant the clear portion. (*c*) Water acidulated with sulphuric acid; for rapid or deep biting add more acid, and keep in a stoppered bottle. For etching on steel: take (*a*) iodine 1 oz., iron filings $\frac{1}{2}$ dr., and water 4 oz. (*b*) Iodine 3 dr., iodide of potassium 1 dr., proof spirit 1 oz., and water 2 oz. (*c*) Pyroligneous acid 4 oz., and pure alcohol 1 oz.; mix, and add 1 oz. of nitric acid. (*d*) Hydrochloric acid 5 parts and water 95 parts; mix and add the liquid to a solution of chlorate of potash, 1 part in 50 parts of water. For etching on gold: nitro-hydrochloric acid, diluted to the required strength, is used. Without dilution, this will dissolve gold. For etching on silver: use nitric acid diluted to the required strength—about 20 of acid to 80 of water. However, gold and silver are seldom or never etched, dry engraving with sharp steel gravers being used.

Etching Metal with an Acid Spray.—In this comparatively new process an atomised spray of the acid is projected by means of an air blast vertically against the metal surface which is to be etched. The compressed air passes from the air tank to the atomiser and to the washing apparatus. Each atomiser is a vessel having a central tube supplied with compressed air and surrounded by smaller tubes in connection with the acid in the tank, the air blast producing a finely divided spray of acid, which is projected with great force against the metal surface required to be etched. The surplus acid falls back to the lower part of the tank and is drawn again into the atomiser, so that the liquid is circulated constantly while the operation of etching proceeds, when, also, the plate being etched is moved about to intensify the action of the acid. When the plate has been etched, it is washed with water under pressure. Erosion under the acid blast is very rapid.

Etching Steel Tools.—This work, in the trade, is sometimes done by an etching process carried out as follows: A rubber stamp making white letters on a black ground is required. Then an ink to use with this stamp is made with resin, $\frac{1}{2}$ lb.; lard oil, 1 tablespoonful; lampblack, 2 tablespoonsful; turpentine, 2 tablespoonsful. Melt the resin, and stir in the other ingredients in the order given. When the ink is cold it should look like ordinary printers' ink. Spread a little of this ink over the pad, ink the rubber stamp as usual, and press it on the clean steel—on a saw blade, for instance. With a strip of soft putty make a border round the stamped design as close up to the lettering as possible, so that no portion of the steel inside the ring of putty is exposed except the lettering. Then pour into the putty ring the etching mixture, composed of 1 oz. of nitric acid, 1 oz. of muriatic acid, and 12 oz. of water. Allow it to rest for only a minute, draw off the acid with a glass or rubber syringe, and soak up the last trace of acid with a moist sponge. Take off the putty, and wipe off the design with potash solution first, and then with turpentine.

F

Fan Repairing

It frequently happens that the end rib of an ivory fan is broken. Take the difficult case of a fracture, about an inch long, so placed that the joining up must be done from the back. Procure a thin veneer of ivory 2 in. long and rather wider than the rib of the fan. Scrape the surface of the veneer and the back of the fracture and fasten together with seccotine or other suitable cement. When set, dress off the sharp edges with a file, and re-form the edges of the carved surface by filing and scraping, taking particular notice that the strengthening piece does not cause the fan to bulge when shut up. If the rib is saw-pierced as well as carved, the holes may now be drilled to admit the saw, which must be carefully worked round the original piercing. A more substantial job, if the fan is valuable, would be to procure a veneer of African ivory about $\frac{1}{8}$ in. thick, the carving and dressing of which would bring it down to $\frac{1}{12}$ in., the relative thickness of the end ribs. For convenience of handling, this veneer may be tacked down by the four corners on a flat piece of wood. The design may now be drawn on the veneer with pencil and the pattern cut with sharp gravers such as engravers use. To get the stuff out clean and smooth, each cut must be repeated till the proper depth is obtained. If the work is merely an incised pattern, filled in either with black or red pigment, the engraving is done with a well-whetted lozenge graver, the work being dressed off when the engraving is done; the filling is set by brushing with wet whiting and then with a softer brush and dry whiting to give the finishing polish.

Fats

Bleaching Dark Fats or Grease.—The general method of bleaching fats is to provide two large wooden vats, one of which is supported above the other. The upper vat is lined with sheet-lead, and is provided with an open steam-coil and stirring gear; the lower vat is provided with an open steam-coil only. The melted fat is run into the upper vat and 1 to 2 per cent. of its weight of sulphuric acid, previously diluted with a little water, is added, and stirred thoroughly with the fat. After allowing this to act for a time, steam is turned on and the agitation continued; the fat is then run into the lower vat, hot water added, and steam turned on. The whole is allowed to stand, and the water afterwards drained off by a tap at the bottom of the vat. More water is then added, and the washing repeated two or three times. The melted fat is allowed to stand until the remaining water has settled out, and is then passed through a filter bag in order to remove any particles of charred organic matter. Stearin and fats that are only slightly coloured may be bleached by heating and mixing with about 1 per cent. of coarse animal charcoal, and filter pressed. Fat may be bleached and also deodorised by stirring it vigorously with hot water, at the same time adding a small quantity of permanganate of potash and sulphuric acid. The fat should then be well washed with water, with the object of removing dirt and acid.

Clarifying Fat.—For clarifying fats that have been used for frying fish, etc., a tall jacketed copper cylinder, through which steam can be passed, will be necessary. If the fat is merely turbid from finely divided burnt particles, it will simply be necessary to filter it; but should further purification be required, then the means for doing this would have to be considered. Fat for culinary purposes should not be treated with chemicals; all that is necessary is to add about 1 oz. of fuller's-earth for each pound of the melted fat, stir it well in, and then allow it to subside in the jacketed cylinder; but before this is done the filtration should be tried. An efficient filter may be made from a hoop of metal fitting tightly within the cylinder, which is suitably supported and provided with a lid, and resting on three supports soldered on the cylinder at about half its height. The hoop should be loosely covered with flannel, which will hang down in the centre. The melted fat should be poured on the flannel, and will pass through it into the lower part of the cylinder, from which it may be drawn by a cock as shown in Fig. 341. An inlet pipe may be inserted near the top, if desired.

Hardening Fats.—Fats that are rather soft may be hardened by submitting them to the action of nitrous acid fumes, produced by the action of nitric acid upon copper; lead acetate is also used for hardening fats. Both these methods, however, render the material unfit for several applications, especially for use as food. The best method is to melt the fats in a tank kept in a room at 70° F. until the mass commences to solidify; it will then appear granular, and must be run through a filter press. The solid portion or stearin will remain as a hard cake in the filter bags, and the oily part which flows through may be also separately collected and sold as tallow oil.

Recovering Fat from Bones, etc.—The process that gives the greatest yield of fat is that in which volatile solvents, such as benzine, are employed; but this process requires expensive plant for treatment of the material and for the separation of the benzine and oil. The simplest plant that is efficient consists of a large pan, which is provided with a lid that can be screwed down, and an opening that is fitted with a valve and lever, which can be weighted so as to blow off steam at any given pressure. The pan should be fixed over a fire, and should be partly filled with bones, etc., and water; the lid should then be screwed down and the fire lighted. After boiling for two or three hours at 10-lb. or 20-lb. pressure, the fire may be drawn and the valve opened; as soon as the steam has blown off the lid can be removed, and the contents of the pan turned out; the liquid will contain the fat in suspension, and the glue (if the pan contained bones) in solution. When

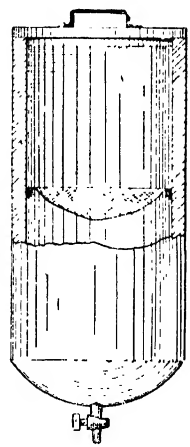


Fig. 341.—Filter for Clarifying Fat.

the contents of the pan have cooled the fat can be removed as a solid cake, and the liquid can be evaporated and the residue sold as size, or still further dried into glue. If a large boiler is used it should be provided with a perforated false bottom, and fitted at the lowest point with a large tap by which the water and fat may be drawn off; manholes (top and bottom) for filling and emptying the apparatus should be provided.

Feathers

Bleaching Feathers.—The simplest and most effective plan of dealing with either disconnected feathers or the actual bird skins, in order to bleach them, is to place them in a closely fitting tin-lined box and

expose them to the fumes of burning sulphur for a few hours. Perfect whitening will thus be ensured. It is impossible to bleach perfectly such dark feathers as those of the peacock.

Cleaning Feathers.—To clean white feathers, dissolve $\frac{1}{4}$ lb. of white soap in $\frac{1}{2}$ gal. of hot water. Holding the feather by the quill, dip it in this solution, and keep it there for a few minutes; then draw the feather through the closed hand, so as to squeeze out the soap and water. Repeat this treatment several times until the feather appears quite clean; then dip in clean hot water, and then in cold. Any yellowness may be removed by the addition of a small quantity of washing blue to the last water. Now dry the feather in a warm room free from dust, and, if curling is required, just before it is dry, take an ivory paper-knife and draw the tufts over the edge of it while pressing them with the thumb. Feathers may be cleaned by washing them in clean water, using a soft cloth, and then absorbing the water with dry plaster-of-Paris. Another method is to wash them in soap and water, followed by clean water, and then by plaster. Or benzoline may be used, finishing with plaster, if desired. In extreme cases, use hot water (steam is better), follow with turpentine, then with benzoline, using plaster last.

Curling Feathers.—(1) A very simple method is to hold the feather straight in the left hand by the midrib and place the edge of an ivory paper knife or the back of an ordinary knife beneath the barbs of the feather, as near as possible to the midrib. Press the barbs tightly on the edge of the knife with the thumb and draw the knife and the thumb together outwards from the midrib, so that the barbs are slowly passed over the edge of the knife from the midrib to the extreme tip; at the same time move the knife edge and the thumb together backwards in a curve. After being released the barbs tend to lie in a curve or become curled. (2) Another method is as follows: Warm an iron rod about 1 in. in diameter by holding it over a gas fire for a few minutes, and place over the rod a piece of tissue paper; put the feather on tissue paper on a table, place the warm iron rod on the edge of the barbs, draw the paper and feather up from the table, and roll the feather round the rod up to the midrib; allow to remain for a few moments, then release; heat the rod, and treat the other side of the feather in the same way. In curling feathers have them slightly moist, and hold them on the rod till quite dry; the curl will then be permanent. (3) Damp the feathers and place them in hair-curling pins for a couple of days. Then carefully comb out. Slightly warm a goffering- or curling-iron, and curl the barbs in batches. Shake well. If merely damp and out of curl, placing the feathers in front of a fire to dry will in many cases re-curl them. Black (dyed) feathers can be curled by holding them for a few seconds in the smoke of a fire. No special tools are necessary, but the work requires care and patience.

Ostrich Feathers.—The plucking of ostrich feathers takes place on the Californian farms soon after the birds are a year old. Plucking is one of the most difficult and dangerous operations of ostriculture. A few birds are driven into a small corral, when one by one they are pushed into a small, angular enclosure, and a long, narrow bag is placed over the head, with a hole in the end to breathe through. Then one man holds the bird, while the operator skilfully clips and pulls at the feathers that are ripe. The bird, now blinded, becomes very tame, but still it is liable to kick, and the men have to be very careful. When a feather root is hurt, injury is done that can never be remedied, for when a "socket" is pulled out, a feather cannot grow again. The short feathers are pulled out without any apparent pain to the creature, as they are ripe and would fall off in the course of nature if not removed otherwise. The heavy wing feathers are cut off with big scissors, the feather stumps being left in the skin. These stumps are ripe for extraction about three months after plucking. The treatment of ostrich feathers freshly plucked from the bird begins with tying them on strings about 4 ft. long, singly or in bunches of two or three, according to their size. Then they are washed in soapsuds, and rinsed frequently, when they are ready

for the dyer. The dyeing of ostrich feathers is almost the first process undertaken by the manufacturer on receipt of the raw feathers. Having been separated and tied by their stems on strings, three in a piquet, the feathers are washed with soap and water, and scrubbed on an ordinary scrubbing board. They are immersed in a vat of red dye for four hours, and then in black dye for twenty-four hours, though the time may vary according to the quality of the goods. The dye is steam-heated to a temperature between 150° and 180° F. Having been taken from the black dye, the feathers are again brushed and scrubbed, and then hung up in strings in the drying-room for about six hours; the drying-room has a temperature of about 150° F. When dry, but before being removed from the drying-room, the feathers are well thrashed out on a board to open the flues thoroughly and to reproduce the dainty effect natural to the ostrich feather. Colour dyeing, in which the various tints such as light blue, pink, cardinal, etc., are given to the feathers, is a much quicker process, occupying less than one hour; but the process of black dyeing as detailed above is both tedious and costly. After dyeing comes more rinsing in clean water containing starch. Next the feathers are beaten on a smooth board until they are free from all particles of starch. They are skilfully finished, and then graded and overlooked. This grading is most important, and years of practice and observation are required to render the operator thoroughly competent. The feathers now go to the sewing department. Each "feather" used in the trade consists of several feathers sewn skilfully together—three, four, or five feathers, according to the value and thickness desired. After being sewn, the feathers are steamed in order to allow the fibres to assume their natural position, and are sent to the curler, who gives them that graceful shape, both in fibres and stem, so much desired. From the curler they pass to the buncher, who combs them and gives them whatever style is demanded at the time for sale in the open market.

Ostrich Feathers: Dyeing Black.—First soften the feathers by soaking them in a warm bath consisting of 1 lb. of carbonate of soda in 10 gal. of water, then rinse in clean water; they are next dyed by soaking them in a bath containing 1 lb. of ferric chloride or nitrate in 1 gal. of water. After again washing, boil them till black in a bath previously made by boiling 2 lb. of logwood and 2 lb. of quercitron bark with 1 gal. of water and straining. If a blue black is required, use 2 oz. of sulphate of copper with the ferric salt. After again dyeing, wash the feathers in clean water, dip in an emulsion made by shaking a solution of carbonate of potash with olive oil, and shake them in the air of a warm room till dried. It will be advisable first to experiment on worthless samples of feathers.

Ostrich Feathers: Making Plumes and Tips.—Plumes and tips are made from dyed feathers which have been dried and well thrashed out; the feathers are cut off the strings on which they are dyed and then sorted according to size. By placing the feathers on boards graduated in inches, this sorting becomes easy work. The feathers are trimmed, the stems shortened, and the head of the feather is trimmed off, the trimmed feathers being piled between vertical sticks according to their size. Then the feathers are graded according to quality, sizes being equal, and are put together ready for sewing. A single ostrich feather, unless it is of exceptional quality, has not the number of flues to give to it the mass which constitutes, perhaps, the chief beauty of a good feather. Hence, it is customary to sew several feathers into one, to do which it is necessary, however, to remove the greater portion of the quill. A girl splits the feather into two parts, a process known as "parrying," although sometimes, instead of splitting the feather, only the quill is sliced off. The ordinary grades of ostrich plumes and tips contain three or four feathers, whilst the finest contain five or six. The feathers are placed one upon the other, and stitched along the stems at intervals of an inch, the outer feather of all having the stem intact, and the others being sewn down upon it. The feather is next "stemmed," that is, a stem of wire is sewn to it, and then it is curled. The curled plumes then undergo the process

of "bending," this consisting of turning over the head of the feather so that the flues are heavily massed. Tips are made in the same way as plumes, except that their ends are bent over more, and the feathers are wired three in a bunch.

Purifying Bed Feathers.—Baking is only possible for chicken and turkey feathers. The feathers of all aquatic birds require treatment to get rid of the greasy impurities. In the absence of proper purifying and teasing machinery, the following method can be adopted: Make up a bath of 12 gal. of cold water, and in this dissolve 2 lb. of alum, 2 lb. of cream of tartar, and 1 lb. of washing soda. Place the feathers in this and allow to stand for three days, then wash them in clean water. Now make a bath of 3 oz. of chloride of lime and cold water. Place the feathers in this for a few hours, then rinse in clean water and dry on a wire grid. The method of cleaning and disinfecting bed feathers is to place them in a cylinder of wire gauze capable of being revolved. The feathers are thus submitted to the action of a current of hot air, which not only cleans them but at the same time destroys disease germs. Failing this, the feathers will have to be washed in weak soda and water, then in carbolic acid and water, and finally dried.

Felt

Cementing Felt to Iron Rollers.—To make a cement for fixing felt to iron rollers, cover glue with moderately strong acetic acid instead of with water, and treat it as for ordinary glue. Another cement is made by dissolving 2 parts of shellac and 1 part of Venice turpentine in 7 parts of methylated spirit. For a firm hold the cylinders should not be quite smooth; it may be desirable to roughen them.

Cementing Felt to Leather.—A solution of shellac will be suitable. To make this, take 1 part of orange shellac, and to it add 2 parts of methylated spirit, stirring till the whole becomes a paste: more spirit may then be added until a thick fluid is obtained. This material may be spread with a stiff brush upon the leather, and then left exposed for a short time until it becomes "tacky," when the felt may be pressed on. After a time the cement becomes very hard.

Felt Hats (*see* Hats).

Proof for Felt Hoods.—The spirit proof for felt hoods is made by dissolving 7 lb. of orange shellac, 2 lb. of gum sandarach, 4 oz. of gum mastic, and ½ lb. of resin in 1 gal. of methylated spirit, and mixing with it 1 pt. of copal solution.

Removing Stiffening from Felt.—If the felt be steeped in methylated spirit for about twenty-four hours, the spirit will become quite brown, and on squeezing the felt and drying, it will be found to be quite soft.

Fern, Preserving (*see* Leaves)

Field Glasses (*see* Optical Glasses)

Files

Cleaning and Renovating Files.—Files require cleaning often if the maximum of work is to be done with them. The filings "pin" and lodge so firmly that a brush will not remove them, and though pinning may be obviated by rubbing the file with chalk, this reduces the bite of the file. A chalked file produces a fine, smooth surface; but the same result is obtainable by using a finer cut file, as the action of the chalk is merely to prevent the teeth cutting freely. For use on fibrous metals, files may be oiled lightly to prevent pinning, but the oil would glaze the surfaces of non-fibrous metals, rendering them more difficult to cut. Oil is removed from a file by chalking and brushing. When files are choked with greasy dirt, lead, tin, solder, etc., boil them in a strong solution of caustic soda (which will dissolve all these impurities), then rinse in water, scrub well with a file-card, wash in hot water, and dry off quickly. If the teeth are choked with such metals as copper and soft brass, first treat as above directed, then immerse in a pickle composed of nitric acid 1 pt., muriatic acid 1 gill, and water 1 gal. If the teeth are blunted, an immersion in the above pickle will rough the worn edges and enable more service to be got out of the files. It is advisable to dip them in the caustic soda solution after they have passed through the acid pickle; then rinse in hot water

to prevent rapid rusting. Another method of renovating the files is to place them in a trough containing good paraffin oil. Let them remain overnight, and then brush them with an ordinary file-card. This will remove grease and dirt. If they are worn out, the best plan will be to have them re-cut.

Testing Files.—A simple test for files—to determine which of two flat files is the sharper—is to lay a small block of metal on the first, then upon the second, and try at what angle the file can be held without the block sliding off. The file which can be held at the greater angle is, of course, the sharper of the two.

Tools made from Old Files.—Tools made from old files are often of extremely good quality. Although the quality of steel used in the manufacture of files varies greatly in different makes, yet the majority of files are made of a fairly good grade, and may therefore be used for any purpose for which tool steel is required. Complete sets of carpenters' chisels from $\frac{1}{8}$ in. to 2 in. may be made from old flat files. Files may also be used to make scrapers for frosting, etc., chisels for hand tooling, where a nice finish is desired on any metal surface, and many other articles of similar shape. Small round files make excellent scribers. Place one inside a coil of insulated wire through which a current of electricity is passing; then if it is suspended carefully by the centre, so that it will just balance, it forms a perfect compass needle pointing to the magnetic pole. Larger round files may be used for centre punches, cape chisels, nail sets, etc. Square files make good cold-chisels, screwdrivers, key starters, caulking chisels, broaches, etc. Knife-blade files, as the name implies, can be ground into extra-fine knife blades. The old files are already hard, and if they can be ground to the desired shape without starting the temper, it is merely necessary to draw the temper to the proper degree, when the tool will be ready for immediate use. The editor of an American technical paper from which the above is taken points out that the author's experience differs radically from that of most mechanics, who have the idea that nearly all files are made of poor stock, high in carbon, and for that reason unfitted for chisels, centre punches, screwdrivers, and tools of that class.

Using Files.—According to the "Bazaar," there is a vast difference between the amateur and the professional mechanic working with a heavy file. The latter will remove in the same time as the former about twice as much metal with about half the exertion, and that with a file which is more worn. The reason is that the amateur uses only the power of his arms, whilst the mechanic only uses his arms and hands for guiding the file. His body applies the power. The mechanic when using a heavy file hardly moves his arms at all. He holds the file at a certain distance from the body, and swings from the hips, with his weight on the file, keeping it at the same distance from his body at the end of the stroke as it was at the beginning. His wrists keep the file level. When a new file is set to work, the curled edges of the burrs which do duty as teeth come in contact with the work, and, as might be expected, from their shapes, they do not give the best possible cutting effect. Being very thin and fragile they are soon broken or worn away, leaving a more or less sharp cutting edge, and it is during this breaking off of the curled tips that the rate of cutting gradually increases to a maximum. Some makers now use a sand blast for the purpose of taking off the curled tips of the teeth. This produces a file which starts work with its maximum sharpness, but at the expense of a certain portion of its life.

Filters

To make a small filter for purifying water, procure a large earthenware flower-pot, well clean it, and fix a piece of glass tube in the hole at the bottom. Put in a layer of very small gravel (flint pebbles for preference); upon this place a layer of fine clean sand, and over that a layer of granular animal charcoal about 4 in. deep. Above all place another layer of clean sand. The filter may be supported on a large jug or other suitable receptacle, and the water run in at the top. Plenty of water should first

be run through the filter so that the sand and charcoal may settle down properly and the filter become efficient; it will be working at its best when the water falls only in drops. Fig. 342 shows a handy filter made from a large flower-pot, in which are placed first some pebbles, next some powdered charcoal, and then some silver sand as shown. The pebbles can be picked up in the road anywhere. Pulverise the charcoal by placing in some brown paper and beating with a heavy hammer. A piece of thin board is put in over the sand to prevent its disturbance while pouring in the water. Water

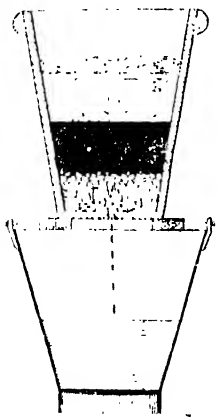


Fig. 342.—Simple Water Filter.

from an iron pump, thick and rusty, comes out with the colour and brightness of distilled water. Another simple filter is made as follows: Procure a large flower-pot and chip the hole in the bottom so that the corner of half a stock brick may project through it. Break some stock bricks into pieces about the size of a marble, and about two-thirds fill the pot with these pieces. Then soak the pot in a pail of water for twenty-four hours, drain, and dry. The filter will now be ready. In use, hang up the pot so that the water to be filtered drops into it, the filtered water dropping through into a pail below. The filter will require an occasional cleansing.

Cement for Water Filter.—Make a paste of white of egg and finely powdered quicklime and apply it at once to the crack; also apply a little of the cement to a piece of tape and press this over the crack. Allow the filter to stand empty a few days till the cement hardens.

Charging Household Filter.—In the older forms of filters, charcoal was used for charging. The general method of filling is first almost to fill the compartment between the two perforated plates with coarsely ground animal charcoal, and on this place a layer about ½ in. deep of fine pure sand. The charcoal should first either have been sieved to remove the dust, or, before using, it should be washed several times with water. The cost will be about 2s. Bear in mind that household filters do not as a rule purify water much, if at all, if it has already been filtered by a water company; and unless filters are frequently cleaned out they may render the water worse than it was previous to being passed through.

Filter-paper.—Strengthened filter-paper is made by dipping ordinary filter-paper into nitric acid having a specific gravity of 1·42; on washing and drying the paper it becomes a tissue of remarkable properties. It shrinks a little in size and weight and leaves a diminished ash on burning. It does not yield nitrogen, and does not affect in even the slightest degree the liquids traversing it, whilst at the same time its filtering properties are not deteriorated; this contrasts very satisfactorily with filter-paper "parchmented" by treating with sulphuric acid. The paper is very pliable, but it may be handled whilst wet without tearing; it is thus particularly adapted for filtration under pressure or exhaust. A strip of ordinary white Swedish paper, ¾ in. wide, will sustain a load of from 8 oz. to 12 oz.; after treatment with the nitric acid it will sustain from 84 oz. 36 grns. to 87 oz. 3 drms.

Fire

The heating effect of a fire in an open fireplace is not generally understood. Open fireplaces warm by radiation. The radiant heat from the fireplace is the most cheerful and pleasant form of heating, and is held to be the healthiest; also the powerful ventilating action of the heated chimney flue

is a strong point in its favour. This form of heat warms the walls and furniture of a room, but leaves the air comparatively cool. No impurity is added to the air of a room, practically any kind of fuel may be employed, and no skilled attention is needed. Another important point in favour of the open fire is that it may be so constructed as to warm the air in its passage into the room. The open fire also serves the double purpose of heating and cooking. There are some important disadvantages, however, of the open fire. It is an extravagant method of heating, a large proportion of the heat being lost by passing up the chimney. There is also a considerable loss from imperfect combustion, the unconsumed carbon passing away as smoke, and it is to this, in a great measure, that the smoke nuisance is due. Some of the air from the room is used up for the combustion of the fuel; also considerable dust and dirt are produced by the burning of the fuel. The heating is unequal at different distances from the fire, the effect lessening as the square of the distance—that is, the heat at 3 ft. from the fire is only a ninth of that at 1 ft. A long room cannot, therefore, be properly heated by one fire; whilst if the fireplaces be multiplied, the heat in their vicinity is excessive. This is, however, in some cases an advantage, as all people do not like exactly the same degree of heat. The position and construction of the fireplace have an important bearing on the question of its efficiency, and by the exercise of skill in these respects, some of the defects mentioned may be to some extent obviated. It is somewhat difficult, also, to regulate the heat from an ordinary fire, and the inrush of cold air into the room towards the chimney which a fire induces often causes draughts—especially along the floor. The above is part of a model solution by Frank Hewitt, in the "Sanitary Record," to an examination question.

Charcoal Fire.—Starting a plumber's charcoal fire in a private dwelling is often annoying to the occupants. A method that works very satisfactorily is to cut off about an inch of a candle, setting it in the centre of a grate and carefully building up small pieces of charcoal around it. In this manner the fire pot can be filled, and in about five minutes after the candle is lighted the fire will be nicely kindled and ready for heating a pot of solder or the soldering-bit.

Cleaning Fire-irons.—The best way to clean rusty fire-irons is to saturate them all over with good sweet oil, and let them stand a day or two to allow the oil to soak into the rusted portions. Then with coarse emery powder, or coarse emery cloth and oil, rub until the rust stains are removed. This must be done thoroughly or the rust will break through again. Polish with fine emery powder, then flour emery, and finish off with putty powder. The work can be done much more easily if a buff wheel is available.

Fire Extinguishers: Liquid.—A liquid for extinguishing fire may be made by mixing together the following solutions in the order named: (1) 1 part of ammonium chloride in 100 parts of water; (2) 1·75 parts of calcined, powdered alum in 50 parts of water; (3) 15 parts of powdered ammonium sulphate in 25 parts of water; (4) 10 parts of sodium chloride in 200 parts of water; (5) 1·75 parts of sodium carbonate in 25 parts of water; (6) 22·5 parts of liquid water-glass. While this mixture is still yellow and turbid, add 100 parts of water, and, when the precipitate has settled, decant into glass containers. Ammonia water as a fire extinguisher has often proved successful. In one case, when the vapour from 50 gal. of petroleum spirit, contained in a tank, caught fire, a gallon and a half of ammonia water thrown into the flames almost immediately put them out.

Fire Extinguishers: Powder.—The following would form very efficient dry powders for extinguishing fires: (1) Sulphate of ammonia 8 parts, carbonate of ammonia 3 parts, boric acid 3 parts; mix. (2) Ammonium chloride 15 parts, boric acid 6 parts, borax 3 parts; mix. All these substances should be in the state of fine powder. Dry powder fire extinguishers were much advertised at one time, but in a presidential address delivered before the American Society of Mechanical Engineers, Mr. John R. Freeman said that the chief reason why these long tin tubes of powder have become popular is that they can be manufactured

for about 5d. each, and that they retail as high as 12s. 6d. each. They are nearly all composed of common bicarbonate of soda, frequently disguised by the admixture of a little cheap colouring matter, like Venetian red, and prevented from caking by the addition of starch. Samples of everything of this kind that Mr. Freeman could find were purchased in the ordinary channels of trade by different parties, and the respective groups of samples were analysed by three different chemists, in order to fortify Mr. Freeman against the possibility of wronging anyone through a mistake in the analyses. He had samples sealed up and retained for further analyses should anyone question his figures. Mr. Freeman had tests made of several of them and found them of doubtful value on even the smallest fires, and worthless for a fire in free ventilation. Generally considered, he would recommend throwing them into the rubbish heap. Pails of water are, in his opinion, far more reliable.

Fire, Gas (*see* Gas).

Fire Gilding (*see* Gilding).

Firelighters

Composition Firelighters.—The material that is used for mixing with sawdust for the manufacture of firelighters is common resin or a mixture of resin and tallow. This material should be melted in a set pot and the sawdust stirred in. The firelighters are made by pressing the mixture in moulds; or the mixture is rolled into a cake on a flat plate and the firelighters stamped out with a metal cutter. Usually about a dozen are stamped in one piece with depressions between the pieces to allow of their being easily broken off. There is no cheap method of making firelighters out of sawdust and shavings. The cost of binding and the extra labour and plant involved in the manufacture of composition firelighters of any kind make them nearly as expensive (in some cases more expensive) to produce as properly made wooden ones. They are, besides,

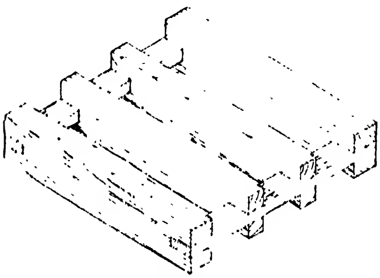


Fig. 343.

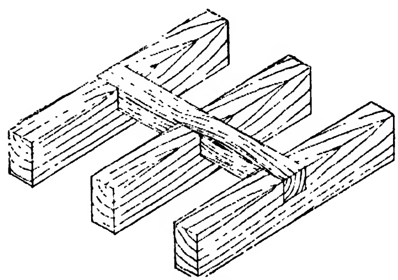


Fig. 344.

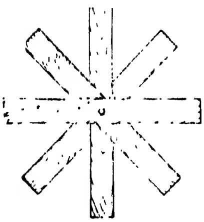


Fig. 345.

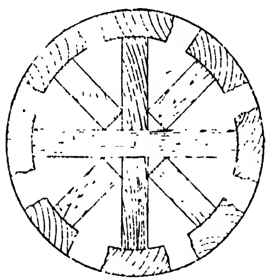


Fig. 346.

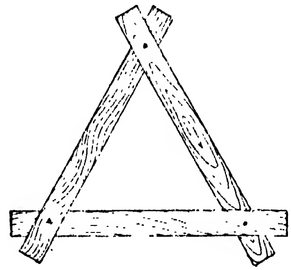


Fig. 347.

Figs. 343 to 347.—Five Forms of Wooden Firelighters.

less clean to handle and to stock. One of the best composition firelighters is made by saturating the sawdust and chopped shavings with only sufficient resin to make the various particles stick together. The material is then placed on a long narrow belt of tough paper. The edges of the paper are rolled up about the sides of the material, and gummed together at the top, just as in cigarette making. When the resin has set hard, and the roll has become stiff and strong, short sections are sawn off, at the ends—like cutting pieces off the end of a pole. Both sides of the discs are then sealed, to prevent any part of the interior from falling out, by being floated over a shallow tray of resin. Tar is sometimes added to the resin or used in place of it, and the saturated composition pressed into brick form while hot. Chopped straw and moss are also used in conjunction with sawdust. The soaking mixture may be varied indefinitely. Wood creosote oil may or may not be added to the resin, and petroleum fat may form 20 per cent. of the liquid employed. In making composition firelighters, be careful not to infringe patent rights, which in this class of fuel are very numerous.

Paraffin Firelighters.—A paraffin firelighter is made by mixing refractory clay with one half of its bulk of sawdust; the mixture is then moulded into an oval mass a little larger than a hen's egg, and with four grooves running lengthwise. The lumps are then burned, and in the process of burning the sawdust is destroyed, leaving a porous mass of fireclay of great refractoriness. A handle of copper wire is attached to this. The firelighter is immersed in paraffin oil overnight, and by the morning will absorb enough oil to burn for fifteen or twenty minutes, with a flame sufficient to kindle any ordinary fuel.

Wooden Firelighters.—Figs. 343 to 350 show a few of the simplest forms of wooden firelighters. If firelighters are to be made for the purpose of sale, care must be taken not to infringe existing patents. The pattern shown by Fig. 344 is the subject of a patent. The pieces in Fig. 345 are joined by a wooden peg. In Fig. 346 a string or wire binding is employed to keep the various pieces in position. Fig. 347 consists of three or more sets of sticks, as shown, the interior being filled up with shavings or other combustible material, and the whole bound or nailed at the corners. In Fig. 350, in a block originally solid, a hole is pierced through the top, and a wide groove made along the bottom. These recesses are filled with tow, shavings, etc. Most firelighters are dipped, partially or wholly, into a hot solution of resin and turpentine. Crude paraffin and crystal oil, carbolic acid and resin oil, and even tar and pitch, are also used; but generally resin is preferred.

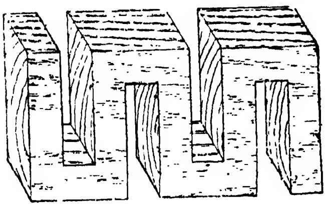


Fig. 348.

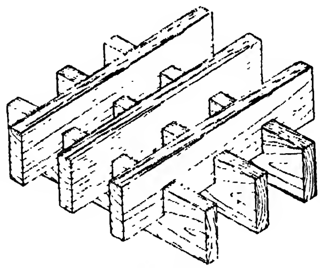


Fig. 349.

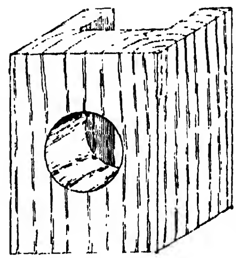


Fig. 350.

Figs. 348 to 350.—Three Other Forms of Wooden Firelighters.

Fireproof Materials and Fireproofing.

Fireproof Coatings.—Reputed fire-proof coatings can be made as follows: (1) Mix together 10½ pt. of freshly slaked, well-sifted lime, 1¾ pt. of powdered salt, and 7 pt. of water; boil, and carefully remove the foam. Slowly stir in 6 oz. of alum, 3 oz. of

powdered green vitriol, 4½ oz. of potash, and about 4 lb. of fine sand or sifted charcoal. (2) Incorporate 25 parts by weight of ground heavy spar with 1 part dry zinc white, and stir in 20 parts of water, and lastly 25 parts of painters' water-glass. This must be stirred before use, and two or three applications are necessary. (3) Dissolve 3 parts of alum and 1 part of green vitriol in 6 parts of water, and with this solution coat the woodwork twice. The surface thus prepared should then receive two applications of a mixture of crushed and sifted potters' clay and water.

Fireproofing Tissues.—Four methods of fireproofing tissues, for which prizes were awarded at the Berlin Exhibition of means for the prevention of accidents in industries, etc., are as follows: (1) For light tissues: Forty parts, by weight, of ammonium sulphate, 12½ parts of ammonium carbonate, 10 parts of borax, 15 parts of boric acid, 10 parts of starch (or 2 parts of dextrin or gelatine), and 500 parts of water are mixed together, heated to 30° C., and the material impregnated with the mixture, centrifugated and dried, afterwards being ironed as usual. A quantity of this mixture, costing about 2d., is sufficient to impregnate 15 sq. yd. of material. (2) For curtains, theatrical decorations, wood, etc.: Ammonium chloride is mixed with as much floated chalk as is required to give consistency; it is then heated to 50° or 60° C., and the material coated once or twice with it by means of a brush. A quantity costing about 2d. or 2½d. is sufficient to coat 5 sq. yd. (3) For cordage, straw matting, cloth, etc.: Five parts, by weight, of ammonium chloride, 2 parts of boric acid, and 1 part of borax are dissolved in about 30 parts of water. In this solution, which is raised to a temperature of 100° C., the material is laid for fifteen or twenty minutes, and is then squeezed and dried. (4) For paper: Eight parts, by weight, of ammonium sulphate, 3 parts of boric acid, and 2 parts of borax are dissolved in 100 parts of water, raised to a temperature of 50° C., and the paper coated with it.

Fire-resisting Cements.—Asbestos putty is a fireproof cement; it should be kept in air-tight tins, but if the tins must be left open, float on top of the putty a little linseed oil. Asbestos putty which has become hard can be softened with linseed oil. Fire cement should be kept in the condition it is in when first made or purchased from the manufacturer. Some kinds of cement require to be kept quite dry, while others should be placed under water. The following is a very good fire-proof cement. Take some magnesite and reduce it to a very fine powder with a mortar and pestle, or other equally certain method. Next make up a mixture of china clay, 28 lb.; barytes, 14 lb.; silicate of soda at 100° Twaddell, 8 liquid oz.; water, 4 oz.; borax, ½ oz. To use, take 1 lb. of the magnesite, and add 3 lb. of the clay mixture; add a sufficiency of water, and use immediately. The following is another good cement: To 4 parts of thoroughly dry and powdered clay add 2 parts of fine iron filings free from oxide, 1 part of peroxide of manganese, ½ part of sea salt, and ½ part of borax. Mix them thoroughly, reduce them to a thick paste with water, and apply quickly.

Fish Glue (*see* Glue)

Fishing Nets, Tanning (*see* Tanning)

Fixatives

Various inexpensive sizes are in use for fixing drawings: (1) Thin water starch, mixed as a laundress mixes it, but of such a strength as to form a thin jelly when cold; (2) Rice water—that is, water in which rice has been boiled; (3) Dissolved isinglass, much diluted. Pencil drawings, if small, can be immersed for a few moments in any one of the above solutions; for larger drawings the solutions may be applied with a broad camel-hair brush, but the safest way of applying a fixative is to blow it on with an ordinary scent spray. On chalk or charcoal drawings, which are easily smudged, the solution may be sprinkled from the brush, a comb being used to produce the "spurts." An old mode of fixing is by brushing stronger isinglass water, quite warm, over the back of the drawing. A preparation for fixing drawings can be bought from any dealer in artists' materials. Pencil drawings may be fixed by washing over with skim milk.

One pint of methylated spirit to 10 oz. of clear resin is another suitable fixative. A fixative for drawings, etc., is made in Germany by dissolving 2 parts by weight of shellac and 1 part of sandarach in 47 parts of spirit of wine. The following method has been advised: Dissolve some isinglass in boiling water, and with a spray producer blow on the drawing until it is damp all over from the spray. Afterwards dissolve some parchment size or Young's patent size—which can be obtained from most oil and colour shops—in hot water in about equal proportions, and go over the water colour with a broad camel-hair brush when the isinglass is thoroughly dry. The picture must be carefully sized all over, for if any part is missed the drawing will be spoilt in the varnishing. A satisfactory method of fixing smoke pictures has yet to be discovered. Possibly the best fixing solution is rice water or a weak and warm solution of starch, which should be sprayed over the surface of the picture. A scent diffuser may be used, or the very inexpensive piece of apparatus that is sold for fixing chalk drawings. This apparatus consists merely of a piece of brass tubing which sinks into the solution, a stream of air blown over the tube causing a fine spray to be distributed. When this solution is dry it binds the particles of carbon to the glass and still preserves the matt surface; varnish or gum instead of starch would, of course, give a polished surface. The most satisfactory way of preserving the picture would be to dispense with the fixing, and, instead, glue a neat strip of thin card around the edge of the glass (smoked face), lay a sheet of transparent glass on the smoked surface, and bind up the two glasses together like a lantern slide.

Flash-lamp Battery (*see* Electric Batteries)

Fleas, Ridding House of

Carbolic powder would be useful; but if the fleas come up through the crevices in the floor, obtain some crude liquid carbolic acid and with a feather carefully cover all the crevices with carbolic, so that there can be no opening through which the fleas can come. This should be done every two or three weeks until the fleas are exterminated or driven away. Keating's insect powder may be sprinkled about in various directions, even on the beds and bedclothes, because the powder is not harmful. A little time may elapse before, in spite of vigorous measures, the fleas are exterminated, because they are breeding somewhere all the time.

Floor

Cleaning Oily Floor.—Wash and scrub the floor with benzoline; then mix 1 lb. of quicklime and 1 lb. of soda in a bucketful of hot water, and with this well scour the floor. A little Calais sand may also be used with advantage. By adopting this method the oil can be easily removed, providing it has not penetrated through the wood.

Cracks in Floor.—To stop floor cracks between boards, preparatory to painting or staining, there has been recommended a filling made of newspapers torn to shreds, soaked in water for twelve hours, and boiled for three or four hours. To each gallon of batter made in this way there must be added 1 lb. of flour made into paste, ½ lb. of glue, and two tablespoonsful of ground alum. The whole is boiled together for ten minutes, and is then ready to be applied.

Polishing Floor.—Before polishing floors that are only occasionally used the usual plan is first to stain the floor boards, if these are of common spruce or white boards; oak or maple boards do not require such treatment. Generally, white boards are stained brown or in imitation of dark walnut or oak, and one pennyworth of permanganate of potash dissolved in 1 qt. of water will produce a useful shade, which becomes darker with each successive application. The floor should first be cleansed and freed from grease by washing with water in which a lump of common washing soda has been dissolved. When dry, any nail holes or cracks may be filled with putty that has been coloured to match by adding a small quantity of brown umber. One or more coats of brown hard spirit varnish may then be carefully laid on; or use one coat o. good oak varnish, which, however, is longer in drying hard. There are also several combined stains and varnishes whereby

the floor is stained and varnished at one operation, the chief disadvantage being that each successive application makes the floor darker. There are also several floor-polishing preparations, foremost being Ronuk, which is easy of application if one of the firm's special brushes is used. A simple preparation is made by dissolving ½ lb. of shellac in 1 qt. of methylated spirit and adding as much dry brown umber as will impart a good colour; apply with a large camel-hair brush or a hog-hair brush that has previously been worked down by use for some other purpose.

Removing Paraffin Oil from Floor-boards.—The best thing that can be done is to place a layer of dried sawdust over the boards and leave it on for some time in order that the excess of the oil may be removed. The boards should then be scrubbed pretty frequently with hot water and soft soap; that and the natural evaporation will eventually remove the paraffin from the boards, but it will require time.

Soundproofing Floor.—Remove the floor-boards, and nail 1-in. by 1-in. fillets along both sides of the joists as close to the ceiling laths as possible without injuring the ceiling. Then get some ¾-in. rough boarding and cut in between the joists, each end lying on the fillets already fixed; the entire length must be covered with boarding. Then fill the space between the boarding and the under side of the floor with fine deal sawdust. The floor-boards are then refixed.

Staining Floor.—Information on this subject is given in the paragraph, "Polishing Floor," above. Staining a floor all over has advantages, says W. Fourniss in the "Decorator." After the staining has been varnished, or, better still, polished, the floor can be easily and constantly cleaned. Moreover, the rugs and squares of carpet laid down to add comfort to the feet can be beaten daily. A carpet nailed down on the floor right up to the skirting looks commonplace, and lies there to accumulate dust underneath till the spring cleaning comes round. Even when a carpet is nailed down, so as to be firmer to the tread, it need not reach the skirting, but room may be left for a border of either plain or ornamental staining. The deep, rich quality of the stained part agreeably contrasts with all other colour in the room.

Floor Coverings

(*See also* "Carpet.")

Cementing and Pasting Linoleum.—Experience has shown that the cementing of linoleum to wood floors results in dry rot, owing to its impervious nature and to the air being quite excluded when the edges are cemented. However, the practice is fairly common. When covering stone floors it is the usual method of proceeding. A very strong cement, suitable for cementing linoleum to wood and stone floors, can be made by dissolving 1 part of garnet shellac in 2 parts of methylated spirit. If this is too stiff, thin with a little more spirit. The mixture should be as thick as treacle. This cement is quite waterproof, and is therefore unaffected by damp. Another cement can be made of 2 lb. of pitch melted with 1 lb. of guttapercha; apply with a brush. A stronger cement is made by dissolving 1 oz. of indiarubber (pure) in 12 oz. of benzole, then adding 20 oz. of powdered shellac. This must be heated very cautiously over a steam pipe and away from fire, or there will be a flare-up. When all is dissolved, apply with a brush. Only the edges of the material want cementing. As a cold floor will chill the cement, warm it with a blow-pipe flame or by drawing a hot iron along where the edge of the material rests. Apply the cement there, and press the material, also cemented at the edges, down in its place. A chalk line could be drawn along the margin of the material, and a border of cement applied inside it, say, 2 in. wide. The edge of the material could then be given a similar coating, and the two would stick well when brought together. For wood floors, good results have been obtained with cements having a foundation of good glue; but these solidify on cooling, and must be heated before application. A good cement of this variety is made up of glue 2 parts, black treacle 1 part, and pitch 1 part. Having soaked the glue overnight in cold water, boil up and add the treacle; then break up and melt the pitch, and add to the other mixture while hot. When cool, it is ready for use. By adding a small quan-

tity of bichromate of potash, the mixture will be almost insoluble after it has set; if this is done, care should be taken not to prepare more than is wanted for immediate use, as it will not work up a second time. Stone and tiled floors require fluid or semi-fluid cements. Dextrin is the foundation of some of these, and may even be used alone in places that are not too dry. To obviate the separation that usually arises through excessive dryness, add $\frac{1}{4}$ lb. of glycerine to 1 lb. of dextrin. Mix them well together, putting in also a few drops of oil of cloves to prevent decomposition. For pasting linoleum to iron stairs, there has been recommended a preparation made by dissolving a mixture of glue, isinglass, and dextrin in water, heating, and then adding turpentine. The linoleum is weighted until the cement is dry and hard.

Hardening Floorcloth.—Holes or impressions in soft floorcloth should be filled up with a mixture of equal parts of boiled oil and varnish made to the consistency of putty by adding a little powdered whiting, which may be tinted to match the floorcloth by the addition of a little dry colour. When this is thoroughly dry, two coats of hard church oak varnish should be given; this will harden the surface of the cloth. The varnish should be allowed to dry for about fourteen days before anything heavy is placed on it. If floorcloth is varnished once a year, it will be found to be as durable as good quality linoleum.

Laying Linoleum.—Linoleums and floorcloths, also known as oilcloths, are not often planned to fit. When they are planned, the method adopted is that shown in a later paragraph. The roll is generally taken to the house, and the plan chalked on the material. The borders, if any are required, are first laid, each corner being cut to a clean mitre with a specially shaped lino knife (Fig. 351); this should be kept well sharpened on a piece of emery cloth glued on a block of wood. When the borders are cut to fit, cement them down with linoleum cement. It is not necessary to cement the whole width of the border, 3 in. from each edge being sufficient; then press well down into position. The body stuff can then be placed in position and marked slightly over the insides of the border, and cut off with the knife; see that there are no blebs or twist in the middle, then slightly undercut the edges to a fit and lay on the cement. Circular and other irregular shapes must be marked with offsets as described earlier in this book for carpet planning. The figuring of the borders or body stuff should be properly matched, as in carpets. Specially prepared thick brown paper in rolls for underlaying linos, etc., can be purchased, and should be laid the opposite way to the run of the lino. Cheap floorcloths should never be cut close to the skirting boards, as the material is so liable to stretch and cause blebs in the middle; these can be prevented by leaving from 1 in. to $1\frac{1}{2}$ in. margin when cutting off. Floorcloths are sold by the lineal yard, and linoleums by the square yards, a roll of the latter containing 50 sq. yds.

Laying Linoleum on Uneven Floor.—It is often difficult to cover a stone-flagged

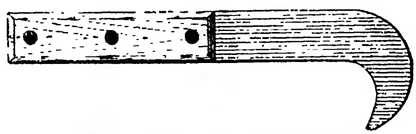


Fig. 351.—Linoleum-cutter's Knife.

or much-worn old wooden floor with linoleum, owing to the surface being worn and uneven, which causes the linoleum to crack. The dampness also will cause the linoleum to get very quickly into a rotten condition. These drawbacks may be obviated by adopting the following method, which ensures a smooth, even surface for the linoleum. Having obtained a bag of sawdust, fill up all cracks and uneven points; then spread the sawdust evenly to a depth of about 1 in. over the whole floor, using for this purpose an ordinary soft broom. When made quite level, place over the sawdust some thick paper felt, procurable from most dealers in linoleum at about 3d. or 4d. per yd., 4 ft. 4 in. wide. When laying the paper, keep any points in it a few inches away from the points or seam in the linoleum, otherwise a little sawdust may find its way through. The linoleum is then laid over the paper and secured to the floor. As

linoleum stretches a little after being laid, especially when not thoroughly seasoned, it is better to leave it loose on the floor for about a fortnight before pasting it down. A stiff paste made of thin glue and wheaten flour is used, a thick coating being given to the edges of the seams, which are afterwards pressed down into place on the paper felt; then the edges, along the skirting boards and in the doorways, are treated in the same manner. This is all that is required to keep the linoleum in position; and if the directions given are carefully carried out, the covering will last for many years.

Laying Linoleum on Stairs.—To lay oilcloth well and economically on a winding staircase is not easy. If the stairs have no painted margin, begin at the bottom and measure across the stairs between the strings or skirtings. Say this is 28 in., then the oilcloth used had better be 18 in. wide (this

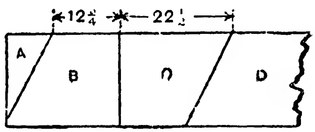


Fig. 352.—Cutting Strip of Linoleum for Laying on Stairs.

is only 17½ in. as a rule) and the painted portion 6 in. wide each side, leaving a space between of 16 in., which will allow a slight overlap. Mark off these distances, 6 in. and 22 in., on the risers all the way up from the side of the staircase in which the bend occurs, allowing for the projection of the newel where it comes; line them in square with the treads, then mark the lines across the treads which will join those on the risers. This being done, prime and paint or grain to fancy, taking into account the shades in the wall-paper or the oilcloth it is proposed to use. In laying the oilcloth, arrange an equal margin on each side in the straight part of the staircase just as with the painting, so that the border will be even all the way up on the inside of the bend. Take the case, for example, where there are three winding stairs at the top of the first flight, then a landing, and some more straight stairs above, the width of the margin on each side of the oilcloth being 5 in. The stair-eyes for holding the rods are spaced ½ in. from each edge of the oilcloth, and if all these distances are marked on a slip of paper they can be marked off on the stairs right up to the top, allowing, of course, for the newel as before. This done, fix the stair-eyes in their places and start at the top of the stairs with the roll of oilcloth. After laying a piece along the straight landing and stairs there, cut it so as to leave about an inch to lap on the first of the treads in the winding part, as shown at B (Fig. 352). Put a stair-rod in to hold it down, then take a paper pattern of the tread so as to get the angles correct, and after cutting it out, see if it will apply to the other treads; probably it will. If so, lay the pattern on, and cut off two sufficiently large pieces to cover the tread and the riser below, with an inch more for lap. Fix these pieces down with a few tacks along the top edge, which will also fasten down the lap underneath. If the winding stairs are not all alike, a pattern should be made for each. The way to cut the linoleum economically is illustrated by Fig. 352, in which it will be noticed that in the before-mentioned example (of which the measurements are shown) only one small triangular piece A is wasted, and an angle is left on the roll ready for the last winding stair D, to which it is fastened, and the rest of the roll is used on the straight stairs below. In this way the borders will be plumb and even on the risers, and on the treads they will be at right angles to the nosing. B and C in the illustration are the first and second winding stairs going down. This plan will apply to any winding staircase, and, after studying the foregoing, the length of material required for any particular staircase may easily be determined.

Planning Linoleum.—In planning linoleum for the floor of a room, the main point to be considered is to have as few joinings as possible, with due regard to economy of material. Fig. 353 shows the plan of a room which will serve as a guide; the measurements given are of course imaginary, but resemble those usually required for linoleum planning. Linoleum is manufactured in a variety of widths, but the three that are most used are 6 ft., 9 ft., and 12 ft. Perhaps the first-mentioned

is made in a larger variety of designs and qualities than any other width. A 6-ft. wide linoleum is called 8/4 in the trade, the sizes generally being given in quarter-yards. Assume that one has to be laid, the room (Fig. 353) measuring 12 ft. 6 in. across, and 14 ft. 6 in. lengthways, which, together with the depth of the bay, makes 16 ft. in all. In this case it will be most advantageous to lay the linoleum lengthways, two widths accounting for 12 ft., while 6 in. will be the space left to be filled in the two recesses by

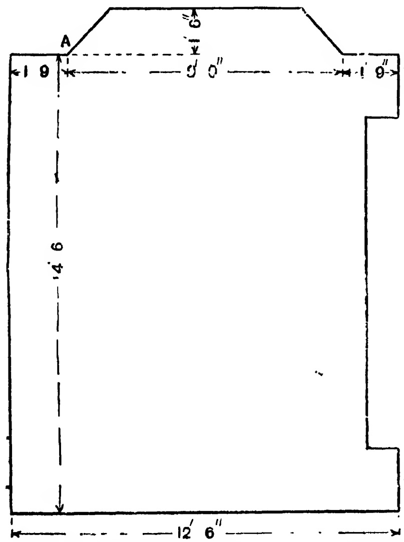


Fig. 353.—Linoleum-planner's Plan of Room.

the sides of the fireplace. Always contrive, if possible, when a narrow strip is required, as in the present instance, to work it into a recess and have the full widths nearest the door. Two lengths of 16 ft. would be cut off, and as the pattern must match, one length must be cut off first and laid out flat on the floor, while another length is unrolled alongside it, the edges are brought together, and the pattern is matched. As the linoleum runs right into the bay there will be two pieces to be cut off, one on each side, and these pieces can be used to fill in the recess where the 6-in. strips are required. Before cutting, however, the linoleum must be laid out on the floor, the two lengths being got into place, with the parts fitting into the bay folded over towards the middle of the room. Bring the edges together with the pattern matching. A few lino brads are inserted to keep it in position. Now cut off the surplus. As already shown, the knife used for linoleum cutting has a curve which enables the user to get well into corners and also to cut easily along the skirting boards. Take up the end of the linoleum that has to fit into

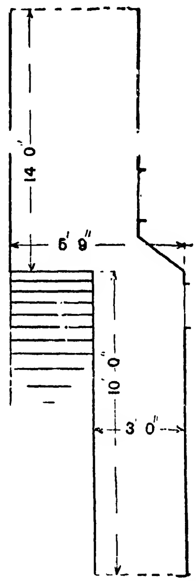


Fig. 354.—Linoleum-planner's Plan of Hall and Passage.

the bay, and cut in a straight line downwards till the corner A (Fig. 353) is reached. This will allow the linoleum to fall into place, but it will still lap over along the skirting board where the bay narrows. Take the knife in one hand, using the other to press the linoleum down, and cut straight along; the linoleum should now drop easily into place. It is better to have ⅛-in. space between the skirting board and the linoleum than to fit it too tightly, for after being laid for a while it will spread slightly, especially when not thoroughly seasoned. If it bulges subsequently, the linoleum must be eased all round, and the tacks or brads taken out, till it lies flat on the floor. Put in as few brads as possible, for if well fitted the lino-

leum should not need to be tacked except near the door and at the edges of the joints. In Fig. 354 a plan of a hall and passage is shown, with the measurements that are usually required. In this case also it will be seen that a 6-ft. width is most suitable. The front hall measures 5 ft. 9 in. across, while the passage is only 3 ft. wide. The correct method would be to cut a length 19 ft., then for a distance of 5 ft. to cut exactly down the centre and across, the piece that comes out being laid end to end, making the narrow width 10 ft. long, while the joint is well towards the middle of the passage. It would be advisable to lay the 6-ft. width down and then cut off the strip; this enables the linoleum to be fitted well into the door part. The plans, of course, will vary in practice, but these instructions show the method to be generally adopted when fitting linoleum and similar floor coverings.

Polish for Linoleums.—Here is a recipe for a floor polish that is specially suitable for linoleums. Dissolve 2 oz. of white wax or beeswax in 1 pt. of turpentine and well mix with about half its bulk of good copal oil varnish. Apply with a woollen cloth, and glaze with a weighted brush or cloth friction. This polish is of a specially permanent and hard-wearing character. It forms, indeed, by degrees a solid, impenetrable, enamel-like film, depending on the grade of varnish used, which acts as a preservative for the softest surfaces against the severest footwear. Moreover, the wax being bound, does not soil the most delicate of ladies' dresses, etc.

Renovating and Preserving Linoleum.—Linoleums are preserved by turning them over and coating the underside with red-oxide paint. When linoleum is much worn, give the worn parts two thick coats of paint made as follows: Mix well together 7 lb. paste paint of the required colour, 1 lb. patent driers, ½ pt. thick boiled oil, ½ pt. oak varnish, and ¼ lb. litharge (powdered). Allow each coat to dry thoroughly, then apply a coat of durable oak varnish. This preparation gives the worn linoleum an elastic coat which, if the materials are good, dries hard in a few hours and will be found very durable.

Flowers

Artificial Ice Flowers.—These resemble the ice crystals which form on windows and elsewhere in such beautiful figures. Directions for forming the Molish so-called ice flowers are as follow: Make a 2 per cent. solution of the best and clearest gelatine in distilled water, filter, and flood the filtrate over any surface to be ornamented—a plate of glass, for instance. Drain it slightly, and if the weather is sufficiently cold, put the plate, as nearly level or horizontal as possible, out into the cold air to freeze. In freezing, water is abstracted from the colloidal portion, which latter then assumes an efflorescent form, little flowers with exuberant graceful curves of crystals showing up as foliage all over the surface. To set these in permanent form, flood them with absolute alcohol. This treatment removes the ice, and leaves a lasting framework of gelatine which may be preserved indefinitely. In order to do this, however, as soon as the gelatine has become quite dry, it should be coated with shellac varnish, or it may be rendered insoluble by contact for a few moments with a solution of potassium bichromate, and subsequent exposure to sunlight.

Colouring Cut Flowers.—Cut flowers may be artificially coloured by placing them in solutions of aniline and other dyes. Aniline scarlet has a very rapid action in colouring flowers pink and scarlet. Indigo carmine produces beautiful blue tints; the two combined produce different shades of purple, and green is obtained by using blue dye with yellow. Narcissi are changed from white to scarlet in twelve hours; lilies of the valley are beautifully tinted with pink or blue in six hours. Sulphurous acid bleaches the colour of red roses to a pale pink. Dipping white roses by the stalks in a solution of colouring matter allows the dye to pass right up the stalk into the flower, but the colour appears only as very fine veinings. It is thought that flowers may be either dyed or their colours altered if the soil in which the plant is growing be watered with a solution of the dye, with acid, or with ammonia. Many vegetable colours—for instance, blues and

violets—are acted upon by acids, which may produce a red, and by ammonia, which may change the colour to green. The only way to get these liquids to penetrate is by the root, where they pass into the sap, and then throughout the plant; but the vitality of the plant is injured by these reagents. Ammonia is an agent for altering the colours of flowers. Put a small quantity of ammoniacal solution in a basin, and erect a support over it for the flower. Blue, purple, and violet flowers become green, white flowers become yellow, and red flowers black; but when vari-coloured flowers are treated, such as white with red lines, the lines become green and white parts yellow. The flowers, if then placed in pure water, retain their new colours for several hours, returning gradually to their original hue. Changing the colour of red roses to yellow is said to be possible as follows: Fasten a red rose inside a glass jar, and hold the jar over the fumes of burning sulphur. The gaseous vapour will destroy the colour of the rose, and turn it white. On dipping it into water, it will resume its red tint.

Mounting and Framing Dried Flowers.—For this purpose, stout Bristol board is most suitable. Laying the specimen thereon in the required position, lightly mark with a pencil the position of the main stems near to their bases and tops, the latter just under the flower-head, with a dot on each side of the stalk. With the point of a sharp knife, cut two longitudinal slits about ¼ in. long in the positions indicated; then cut strips of stout paper of equal width. Replace the plant once more in the same position, and secure it to the card by slipping these bands through one slit, over the stem, and through the other hole; finally secure the ends, by means of fish glue, to the back of the card. Any small outstanding shoots may be secured with a minute quantity of the adhesive where necessary. In framing, it will simply be necessary to fit a beading, of sufficient depth to prevent the broadest flower touching the glass, between the glass and the mount; secure the back of thin wood with fine brads driven obliquely into the frame, and paste over brown paper.

Preserving Cut Flowers.—To preserve cut flowers for a short time they may be sprinkled constantly with water, and their stems placed in a mixture of 30 parts by weight of water, 30 parts of white soap, and 3 parts of salt. When the soap has dissolved entirely, a small quantity of borax is added. The process is stated to be particularly useful to those who make a speciality of photographing cut flowers. Coating flowers with wax will not preserve them for any length of time. Flowers contain a considerable quantity of water, and, even if coated with wax, evaporation will take place and the flowers will shrink and die. Wax may, however, preserve them for a short time; a soft white paraffin wax would be best. The natural colours of flowers are so extremely sensitive that they rapidly fade or change by keeping. The natural appearance of flowers is most probably kept by dyeing or tinting with solutions of aniline dyes of the same colours as those seen in nature; this must be done with solutions in water. The fleshy appearance of the flowers may possibly be kept by placing the cut flowers in a solution of glycerine and water, which, after a time, will be absorbed; on drying, the glycerine remains in the plants. However, the following method is well spoken of. Dip the flowers, immediately after gathering, into weak gum water, and after allowing them to drain for a few minutes arrange them in a vase. The gum forms a protective coat on the flowers, and preserves their shape and colour for a long time after they have become dry. To preserve flowers for merely two weeks or so, keep their stalks in a weak solution of saltpetre or carbonate of soda in water. By standing a vase of cut flowers in the centre of a flat dish in which is a little water, and inverting a bell glass over the vase, the flowers will be surrounded with a moist atmosphere, and their life will be prolonged. Or, instead, when treating small and short-stemmed flowers, insert them in damp silver sand and invert a tumbler or a bell glass over them. Cutting off the ends of the stems assists keeping.

Fly-marks

To remove fly-marks from paper, take a piece of soft bread, moisten it very slightly, and roll it into a ball; rub the paper with

this just as though using indiarubber, until the marks disappear.

Fly-papers

Poisonous Fly-papers.—Poisonous fly-catchers can be made either with arsenic or with quassia. With arsenic: 1½ dr. of white arsenic, ½ oz. of carbonate of soda, and 1 pt. of water; boil together till the arsenic is dissolved, then stir in 2 oz. of treacle. Dip brown paper in the solution and allow to dry. Take very great care in handling this material, as it is a deadly poison. With quassia: boil ¼ oz. of quassia chips in 1 pt. of water, strain, and add 2 oz. of treacle; dip the papers in the solution and allow to dry. Poisons and preparations containing poisons can only be sold by properly qualified chemists.

Sticky Fly-papers.—To make sticky fly-papers, into a small earthenware jar containing 3 dr. of colza oil, stir in a full ½ oz. of finely powdered resin; then stand the jar, glue-pot fashion, in boiling water till the resin is thoroughly melted. Stir well, and apply while hot to parchment or highly glazed paper by means of a good bristle brush. To test the material, brush a small quantity of it on a piece of paper and throw on it a fly; if the latter be able to crawl over the paper add a little resin, and again heat the mixture, as the oil when fresh is thinner, and consequently less adhesive. Another composition: Boiled linseed oil, 3 parts (by weight); gum thus, 1 part; castor oil, 1 part. The ingredients are heated, well mixed together, and applied to the papers while hot. If gum thus cannot be obtained, Venice turpentine or Canada balsam might be used instead. For use in climates where there are very long spells of hot weather, some modification of the ingredients is required. Preventing the drying up of the paper is simple enough, but proportioning the ingredients so that the mixture does not remain too fluid and so lose its stickiness is a more difficult matter. The castor oil may be increased to 2 parts, or even more; or if the castor oil makes the mixture too thin, reduce the linseed oil to 2 parts, keeping the proportions of gum thus and castor oil as they were.

Football Repairing

Punctures in football bladders are repaired with a solution of indiarubber in solvent naphtha. The solution is applied around the puncture and allowed to dry. A small circular piece of thin sheet rubber is then cut out and treated with the rubber solution, which is also allowed to dry. Both the bladder and sheet rubber are treated a second time with the solution and pressed together until they adhere closely; the bladder is then set aside till the solution has properly dried.

Formalin

Formalin is the short term given by the Schering factory to a saturated 40 per cent. solution of formic aldehyde, the product of imperfect oxidation of alcohol, states a model answer to an examination question given in the "Sanitary Record." Formalin is supplied in various forms in a liquid state, and also in a dry form for gasification, the latter being convertible into active formalin gas by a patent lamp (the "Alformant"). This lamp is so constructed that when the stable body "paraform" is in the act of subliming, a sufficient quantity of water and carbonic acid is led over the product of sublimation to convert it into active formic aldehyde, this being done by the water of combustion supplied by a spirit flame. Paraform, or formalin in tablets, is a white solid; it is a stable chemical compound, not altered by heat, and only moderately antiseptic. One gramme of paraform is equal to 2½ grammes of liquid formalin. On the Continent, lamps have been used for generating formic aldehyde directly from methyl alcohol. Another method has been introduced in which the gas is obtained by heating formalin mixed with 10 per cent. of glycerine. Formic aldehyde gas is a strong-smelling, powerful antiseptic, of great penetrative power. It has been much used for the preservation of foods, but its employment for this purpose has been questioned.

Fountain Pens

Fountain pens—pens which have an ink barrel in the holder which supplies ink

as required by means of an automatic feed—may be said to consist each of four pieces of hard rubber and an ordinary gold nib. The handle containing the ink reservoir is in two pieces, which are connected with a screw joint, that permits it to be taken

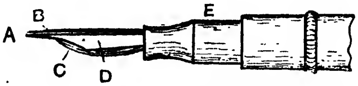


Fig. 355.—Nib End of Fountain Pen.

apart readily for filling. The gold nib is held in the point section by a rubber ink feeder lying adjacent to it, to attract the ink from the reservoir. As the ink in the process of writing is withdrawn, air enters at the lower end of the holder and ascends in globules through the column of ink to fill the space left vacant. The fourth piece of rubber is the cap, which covers the nib to protect it from injury, and to keep the ink from drying when not in use. A fountain pen usually holds ink enough for writing from 15,000 to 20,000 words without refilling. The rubber which goes into the making of fountain pens is the best obtainable, coming chiefly from Para, Brazil, and reaching the pen factory in chunks as large as a man's head. It is there first torn apart, washed, and then allowed to dry for several months. After this it is rolled out, in shape like a sheet of iron, sprinkled and rolled in sulphur, and made ready for working. In this condition it is next rolled on steel cylinders or mandrels, and placed in a steel heater for several hours. The metal rods are then withdrawn, leaving the empty cylinders, and the outside of the various parts are smoothed down with lathes, polished, and then worked on so as to fit one another. A fountain pen, as shown above, has a nib and also a reservoir containing ink. This ink flows automatically to the nib point, and the flow should be sufficient to enable the most rapid stroke to be made without failing, and at the same time not free enough to cause blotting if writing is stopped for a few minutes with the pen point held downwards. A pen that will not bear these tests is nothing but a nuisance. On the other hand, every fountain pen, including the cheapest, is capable of being put right with a very little trouble. At first, mechanical means were supposed to be necessary to supply the nib with ink from the reservoir. Thus, one of the first pens made consisted of a steel nib set in a hollow metal tubular holder containing a rubber tube, which was the ink reservoir. This ended in a small tube just under the nib and fitted with a valve. When another drop of ink was needed, pressure was applied by one finger to the rubber tube and a drop of ink was caused to flow into the nib. But since then it has been found that ink in a reservoir will flow automatically by capillary attraction if a suitable arrangement of surfaces nearly in contact is made for it. In modern pens this principle is used. Thus, if a tube, closed at one end and having a small orifice at the other, be filled with ink and held with the opening downwards, the ink will not run out unless it is shaken. But if the opening is rested on a flat surface and the tube moved along, it will empty itself, leaving a trail of ink on the surface. This is the principle of the fountain pen. The ink is in the holder, closed at the top end. It is conducted by capillary attraction through a small opening at the lower end and between several surfaces to the nib point. When the nib is applied to paper and moved, a small trail of ink is left, and this will continue until the ink in the reservoir is exhausted. A great deal depends on how near to the nib point the ink can be carried in a sufficient body to ensure a mark being made immediately. In Fig. 355, A is the nib and B and C are feeders, which are usually

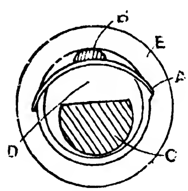


Fig. 356.—Cross Section through Feeders of Fountain Pen.

made of vulcanite. The bottom feeder C is the larger, and reaches the nib with a curve, leaving a space under D for ink. It passes through right into the ink reservoir, and, though tight in its hole, does not accu-

rately fit it, leaving a space for the passage of ink. Similarly, the top feeder B is a thin slip of vulcanite or gold wedged into a hole or hollow over the nib and passing through into the reservoir, but not fitting the hollow; it allows the ink to flow by capillary attraction along it and between it and the top of the nib. Fig. 356 is a section enlarged, showing the way the feeders fit the holes. In nearly all pens the point portion E screws off to fill the reservoir. The nib and the feeders are all firmly wedged into E. As a rule, E has a central hole about $\frac{3}{16}$ in. in diameter right through it. A nick is filed or cut on each side and a nib pushed in tight. The nib thus divides the hole into two, an upper and a lower part. The upper part, as shown in Fig. 356, is crescent-shaped, and the top feeder may be simply a thin piece of vulcanite jammed into it tight, partly blocking the hole, and preventing too much ink flowing. The under part of the hole is nearly filled with the bottom feeder, which is wedged into it.

Adjusting Ink Flow in Fountain Pen.—The ink flow, if excessive, may be lessened by inserting small thin vulcanite wedges like F farther round G (Fig. 357), or it may be increased by filing or otherwise making a flat on G along its entire length. A pen that blots when held still point down should be given less flow. One that runs short in rapid writing wants more. A pen that fails to mark a rapid horizontal line when the nib point is very lightly run across the paper requires the ink to be conducted nearer to the nib point by increasing the length of the top feeder, or if the top feeder is long enough it must be given more top flow by enlarging the hollow into which the top feeder is wedged, or by narrowing the top feeder where wedged in so as to leave more ink space; or the top feeder may lie too close to the nib, leaving no ink space.

Aluminium Fountain Pens.—These have a good appearance, but are likely to give rise to a frothing up and dribbling over of the ink due to the formation of gas produced by the action of chemicals in the fluid upon the aluminium or aluminium-zinc alloy. Aluminium is attacked very strongly by hydrochloric acid, being converted into aluminium chloride and freeing hydrogen; thus $2Al + 6HCl = Al_2Cl_6 + 6H$. Solutions of potash or soda also easily dissolve Al, forming the so-called aluminates, thus: $6NaOH + 2Al = Al_2(NaO)_6 + 6H$. By using a neutral ink, such as can be prepared by dissolving neutral aniline salts in water, a chemical action will not occur, and the aluminium fountain pen will be found both ornamental and useful. For black ink, water-soluble nigrosin can be employed.

Carrying Fountain Pen.—If held point down and shaken, or if held horizontal and shaken continuously, any pen will blot. Therefore a pen should be carried in the pocket point upwards, as otherwise the movements of the body will cause a loss of ink and messy fingers. The best way to ensure the pen being always point up is to have a pen-pocket made just deep and wide enough to take it. Or the waistcoat watch-pocket may have a seam run down its side leaving room for the pen, as in Fig. 358. A few makes of pens are provided with a screw-down valve to stop the flow when not in use. These can be carried in any position, but cannot be brought instantly into use as the other can.

Cleaning Fountain Pens.—In cleaning a fountain pen, says Mr. J. P. Maginnis, it is a great mistake for those inexperienced in such matters to attempt to take all the elements apart, owing to the difficulty met with in putting them back in their correct relative positions. It is also a difficult task to cleanse the minute passages thoroughly, and free them from foreign matter accumulating there, which soon becomes hardened and obstructs the flow of ink and air. The simple device now explained is most effective in its action. It consists of one of the little pipette tubes supplied with fountain pens, fitted into and passed through a cork slightly tapered. This is placed in the water-supply tap, with the result that a fine jet of water is produced, issuing from the point at a pressure so great that if the point section of the pen be unscrewed and the jet allowed to play into the passages, all impurities will quickly disappear, and the pen be thoroughly cleansed.

Feeders of Fountain Pens.—Fig. 357 shows the form of the feeders and the way they are

ixed more particularly. The top feeder B goes but a short way in over the nib A, but the bottom feeder C goes right through and s really a round rod of vulcanite a little smaller than the hole through E. It is secured by the vulcanite wedge F, which keeps it tight, leaving an ink space round t. It is cylindrical for a short distance, and is then filed to a half-section and finally tapered to a point, which is bent to a curve to suit the nib. Fig. 359 shows a plan used when held for a moment still. A few pens have only the top feeder. In these there is no failing on a quick light stroke, but in continuous heavy writing the ink supply is liable to run short. A feeder can easily be added as required. A vulcanite knitting needle can be purchased of a suitable size to wedge into the hole in E as at F (Fig. 360), and can be sawn, filed, or cut and scraped with a pocket-knife. It can be bent by heating it in hot water to soften it and hold-

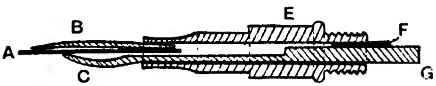


Fig. 357.—Longitudinal Section through Nib End of Fountain Pen.

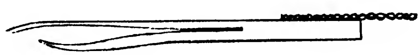


Fig. 359.—Feeders of "Swan" Fountain Pen.

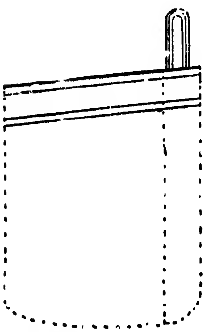


Fig. 358.—Method of Holding Fountain Pen in Pocket.

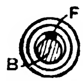


Fig. 360.—Cross Section through Fountain Pen Feeders.

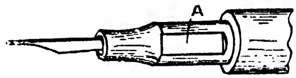


Fig. 361.—Flat formed on Nib Section of Fountain Pen.

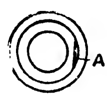


Fig. 362.—Flat formed on Nib Section of Fountain Pen.

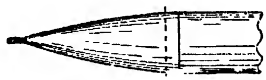


Fig. 363.—End of Stylograph Pen.

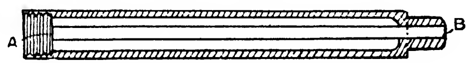


Fig. 364.—Section of Stylograph Pen.

n the "Swan" pen. In it both feeders are in one piece, and are made from a vulcanite tube or quill, which is split. It is wedged into the pen by a twisted wire wedge, and the nib comes between the upper and lower feeders, as in Figs. 355 and 357. Many cheap pens have only one feeder—the lower one. This causes many faults. First, the ink is not conducted near enough to the nib point, as an under feeder would come into contact with the paper if carried very near the end of the pen. The result is, the pen often fails to mark when moved quickly. If, to avoid this fault, the flow is made more free by enlarging the ink aperture, the pen is liable to blot ing it in position until set. Or it can be softened by holding in a warmed pair of pliers and bent; or it may be bent over a warm iron rod. A top feeder should not lie flat on the nib top, but should be slightly curved.

Nibs of Fountain Pens.—A steel nib in a fountain pen will rust in a day and be almost useless. In ordinary pens, when not in use, the ink dries; but in a fountain pen the nib is always soaking in ink. A gilt steel pen is a little better, but must be changed once every few days. Composition pens are made and are better than steel, but the points wear out with friction on the paper, as do all ordinary pens. Replacing a nib

in a fountain pen is rather a delicate operation, as it means readjusting the top feeder. Therefore, a nib that will not corrode and with a point that will not wear out is a necessity. To avoid corrosion, gold of not less than 12 ct. is necessary, and most good pens have 14-ct. nibs. Nibs of 9-ct. gold, or less, though they do well for a year or so, eventually rot through and develop cracks, till one day they surprise their users by dropping in two. To prevent wear at the point, the nibs are pointed with iridium, a whitish metal and the hardest substance known. Small pieces of it are brazed on to the points. Such nibs will wear a lifetime unless accidentally broken. Imitation iridium-pointed nibs wear and begin to splutter in a week or two. The two points of a nib should just touch each other lightly. If they do not quite touch, the flow of ink will fail when a light stroke is made. If the halves press hard sideways against each other, the nib will be liable to cross if used a little on one side; besides, the pen will be hard and will require considerable pressure to write well. A pair of small round-nosed pliers may be used to straighten a nib if accidentally bent, or the nib may be handled between paper with ordinary pliers. The ink should be taken clean from the bottle and not from a dusty and dirty inkpot. Dirty ink causes particles of dust, etc., to collect round and under the feeders, and stop the flow.

Point-covers of Fountain Pens.—The point-cover is a tube, closed at the end, fitting on a cylindrical portion of the penholder and completely covering the nib and feeders. If it fitted well and were drawn off quickly, a partial vacuum would be formed inside until it got clear of the holder. This would cause it to draw ink out of the pen and partially fill, giving the impression that the pen had leaked into the point-cover. To prevent this, many pens have small ventilation holes in the point-covers. These do not always act, for if the cover is grasped in such a way as to cover up the holes with the fingers and thumb, it will fill with ink as before. Also, these ventilation holes are a nuisance, as they admit air to the nib while in the pocket and dry the ink in the nib point. This causes the pen to fail to mark at once when taken out to write. Several strokes have to be made before the ink can be coaxed to the nib point. The only effective way to prevent a vacuum forming in the point-cover is to file a flat at A (Figs. 361 and 362) on the cylindrical part of the penholder on which the cover fits. This flat should not reach quite to the bottom, so that the cover when on is air-tight; but when the cover is pulled up the least distance, air is admitted along the flat. When covers are fitted thus no air ventilation holes are necessary, and the ink never dries up while the pen is in the pocket. A pen with a ventilated point-cover should be served like this and the holes carefully stopped with wood pegs fixed with seccotine cement and cut off level outside and in. They can be blacked with ink so as not to show.

Stylograph Pen.—A stylograph, or ink pencil, is a fountain pen without a nib; instead, the ink flows from a small circular orifice at the point. Internally a stylograph is a little complicated. It is designed to give the air proper access, and the point invariably tapers down until it ends in a small metal tube with a minute central hole. Impure ink constantly clogs up this hole and stops the flow. For clearing the point a fine wire is supplied with each pen; but many stylographs, in spite of the greatest care, will only write erratically. The metal tube point wears and gets scratchy; the remedy is to smooth it up, rounding it on an oilstone. A few of the original and expensive stylographs, like the "Mackinnon," had iridium points to the tube, but the other faults remained.

Stylograph Pen: Converting.—An unsuccessful stylo can be converted into a successful fountain pen with a little trouble. First, saw off the point as shown by the dotted line in Fig. 363. Open out the central hole by filing or otherwise, parallel and true. Cut two nicks, one on each side, to take the nib, which should then be pushed in tight. A gold nib with iridium point can be purchased from a fountain-pen shop. Procure a vulcanite knitting-needle and make two feeders, as in Fig. 357. The pen part is then complete, but the reservoir remains to be altered, and, as a rule, is

something like Fig. 364. A central tube A is fixed in the top end B. To get this out, bore in the centre of the end B right through until A is completely cut out. Then plug the hole at B with hard wood fitted well and driven in, smoothing it off outside and blacking it with ink. The fountain pen will then be complete. The point-cover will be found to have a small indiarubber pad inside. This can be removed and, if necessary, the cover can be hollowed out more by scraping or drilling to clear the new nib. A ventilating flat can be cut like Fig. 361, and any holes plugged up.

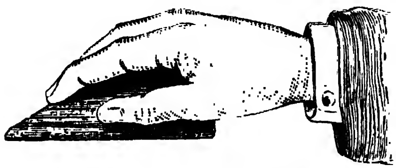


Fig. 365.—Method of Holding French Polishing Pad.

Frames (*see* Gesso and Picture)

French Chalk (*see* Talc)

French Polishing

Materials.—French polish is a solution of shellac in methylated spirit, the proportions being 6 oz. to 1 pt. For white—nearly colourless—polish, white or bleached shellac is used ; for ordinary polish—brown polish—the orange or reddish-brown shellac is used. If the polish is too thick, add more spirit ; if too thin, add more shellac. The polish is applied with a pad—called a rubber—consisting of wadding enclosed in a seamless piece of old cotton or linen rag free from loose fibres, lumps, knots, etc. If new rag must be used, wash it out thoroughly. The rubber is shaped as in Fig. 365, and the contained wadding is originally a 6-in. by 9-in. piece of sheet wadding, folded and then pressed in the hand until of the right shape. The polish is poured on to the wadding and never on to the face of the outside rag. Have the polish in a bottle the cork of which has a channel or groove cut in it to allow of a few drops being shaken out. This will provide the rubber with enough polish at a time. Gather up the corners of the rag, press the rubber into the palm of the other hand so as to distribute the polish, and it is ready for use.

Method.—The object is to get a good and even body of polish on the wood. A wood surface to be french polished must first be made smooth with plane, scraper and glasspaper, and the pores of the wood must then be filled with whiting mixed with turpentine, well rubbed in and then wiped off clean. Dozens of other fillers, including polish and varnish, are available, but the above answers very well. To start the actual polishing, quickly wipe over the entire surface, using moderate pressure on the rubber, first with the grain of the wood, then across it. Then immediately go over it more carefully, following roughly the motion indicated by Fig. 366. Use gentle pressure at first, increasing it as the polish gets worked in and the rubber becomes drier. But always rub, not scrub. Keep the rubber while in contact with the wood constantly in motion. It must not rest on the work during temporary absence or at the end of the day's work. As the rubber gets dry it must be recharged with polish in the way already described, but be careful not to use this in excess. Aim at getting the polish evenly distributed over all portions, and, if needful, coat the extreme

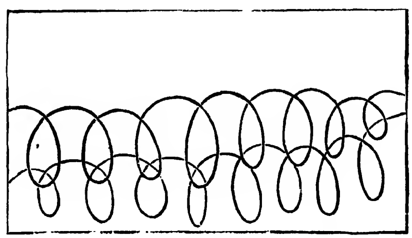


Fig. 366.—Path of Rubber in French Polishing.

edges and corners with equal parts of varnish and polish, or wipe the tip of the glaze rubber, described later, over these parts previous to the spiriting out (a process yet to be described). Each stroke of the rubber should overlap the previous one.

Avoid working in straight lines; something resembling a circular movement is indicated in Fig. 366, but perhaps even better results are obtained by letting the motion resemble figure 8's, letters S, and small a's. To obviate dull corners and edges, keep well up in the corners and on the outside edges; the middle will take care of itself. Bodying means coating the wood with a thin, evenly distributed layer of the polish, as already described. If the body is too thin, the gloss that is put on will fade as the polish sinks or perishes. A thick body impairs the pure tone of some woods, and the work is apt to look treacly, as though varnish had been used. In order that the rubber may work smoothly without sticking, a very little raw linseed oil should be used. The tip of a finger, moistened with oil, and touched on the face of the rubber, is all that is required. Raw linseed oil may be worked first over the natural woods to give them that peculiar tone that cannot be gained by other means; otherwise the less oil used the better for the durability of the work. Oil in polishing is used only to enable the gums to be worked easily; without it the polish rubber is apt to stick or drag, thus breaking up, instead of levelling, the surface. A small quantity of polish goes a long way; carefully avoid making the rubber wet with polish. Too much polish causes the shellac left by the quick evaporation of the spirit to be ridgy and irregular, instead of in a fine, even coating or body. Anything approaching a flow of polish from the rubber must be avoided. On the other hand, when the rubber is not sufficiently charged with polish, the labour of bodying up will be unduly prolonged. The first bodying-in process should be continued till it seems that the wood cannot absorb more polish. There will be a perceptible gloss on its surface, but it will be streaky, and the rubber marks will show very distinctly. The work should stand for at least a day, carefully covered up from dust; then the body will be found to have altered in appearance to an extent which will depend upon how much the polish has sunk into the wood. The work must be again bodied up as before, using as little oil as possible. Again stand the work aside, and repeat the bodying process till the polish no longer seems to sink in. Now the bodying is complete, and the work is ready for the final polishing operations. Fine, close-grained woods will not require so many bodyings up as the more open kinds, but for the best and most durable work they need rarely exceed four. The final bodying up may be regarded almost as the beginning of the spiriting off. Between each bodying, especially after the first and second, rub down the surface of the work with fine glasspaper, just enough to smooth the surface, but not to rub the body off. Pumice powder, used in moderation, is useful for working down inequalities of surface. Spiriting off is the final operation in french polishing, by which the gloss is put on the body previously applied. This operation removes rubber marks and all kinds of smears, and the beautiful french polish surface is the result. Spiriting is perhaps the most severe test of skill in the whole process of polishing, and it consists in washing the bodied surface with methylated spirit. The final bodying up, or first spiriting off, consis s in gradually reducing the quantity of polish in the rubber, and increasing the quantity of spirit. The polish is gradually reduced by the addition of spirit till all the polish has been worked out of the rubber. The rubber could, for instance, be charged, first with three parts polish and one part spirit; next with equal quantities; the third time three parts spirit and one part polish; and the fourth—for spiriting off—charging will be with spirit only. For spiriting off, the rubber should have been used only for spiriting, and not contain polish. It should have on its face three or four coverings of rag, and these can be removed as they dry. With only one cover the spirit is apt to evaporate too quickly. The spirit in the rubber tends to dissolve slightly the shellac or body on the wood. If the rubber is made too wet, there is danger of washing away the body. Therefore, there should be only enough spirit to allow the surface of the body to be softened and smoothed. The rubbing should be uniform, and at first gentle, becoming harder as the spirit dries off; oil must not be used on the rubber

face, for when there is oil either on the rubber or on the work, the polish cannot be brought up. Failure in spiriting out lies chiefly in having the spirit-rubber too wet, and so softening and tearing up the gums. If done correctly, the gloss will soon begin to appear, and when it seems approaching a finished condition, the rubber ought to be moved in the direction of the grain only, and not across it or with circular motion. Give the final touches with the soft rubber rag alone, taking care not to scratch the surface, which is now softened by the action of the spirit. The surface will gradually harden, but for a time it should be handled with care, and nothing allowed to come in contact with it, or it is very likely to be marked. It should also be protected from dust.

Glazing as a Finish to French Polish.—The difference between spirit finish (just described) and glaze finish is that in the first case the effect is produced by friction, and in the second by the addition of a thin, fine varnish. In the first case, the body of shellac itself is polished; in the second, it is varnished with a mixture known commonly as glaze, but to which other names are sometimes given. The ingredients of glaze are the best gum benzoin and methylated spirit. After the benzoin is dissolved, the solution should be strained through muslin to free it from foreign matter. The proportions are 5 oz. or 8 oz. of gum benzoin to each pint of methylated spirit. When gum arabic, gum mastic, gum copal, or some other tough gum is added, it is a common practice to add a quantity of powdered glass so as to cut the gums when the mixture is stirred up or agitated; the glass forms no part of the glaze itself, and needs very careful straining to avoid getting any on the polished surface. Glaze may be applied with the ordinary rubber, sponge, or brush; in most cases the rubber is most suitable and is most commonly used. The glaze is laid on rather than rubbed into the work, which must have been previously bodied in. The rubber for glaze should be made wetter than for polish or spirit; although it should not be so wet as to drip, it should wet the wood when it is very lightly pressed on it. One or two wipes in the direction of the grain of the wood, with a somewhat quick motion, will put the glaze on. Always let the glaze dry before applying the rubber again to the same place. Repeat the coats till the gloss is satisfactory, but do not make the film of glaze a thick one. When a brush is used, the glaze may be applied simply as a varnish. A mixture, in equal quantities of glaze and french polish, either white or brown, according to the work, may well be used with a brush.

Fretwork

Cleaning New Fretwork.—Workers who paste the design on the wood find that removing the design leaves the wood very dirty, and glasspaper fails to clean it. The best plan would be to take off a thin shaving by means of a sharp steel scraper, as used by cabinet makers. The clean-cut edge of glass is a passable substitute; either should be held at an angle of 45°, about the same as that of a plane iron. Glasspaper held tightly round a flat piece of cork will do the rest. An alternative plan would be to wipe over with a solution of oxalic acid, ½ oz. to 1 pt. of water. All trace of this should be afterwards neutralised by wiping over with common vinegar. But prevention is better than cure; use carbon paper and transfer the designs, and this will be found to do away with the dissatisfaction which pasting patterns on the wood gives.

Darkening Oak Fretwork.—To darken oak fretwork without destroying the figure, dissolve one pennyworth of bichromate of potash in 1 pt. of rainwater. Then brush the article all over with raw linseed oil, using a painter's sash tool to ensure getting it well into all interstices. Now dip the same brush into the potash solution, brush the stain well in, and whilst still wet rub down with No. 0 glasspaper to cut down any apparent roughness. Brush over with the stain again, and wipe off any surplus with a rag. Excess of oil and stain should be avoided, and to counteract any tendency to twisting, treat both sides alike. The above stain may be applied several times, and will impart an appearance of pollard oak. Should a still darker tone be required, use permanganate of potash instead of bichro-

mate. During the operations it is a good plan to have the work apart, and laid down on a newspaper.

Duplicating Fretwork Designs.—The materials required are as follows: A tube or tin of printer's ink (black); a slab consisting of slate, plate glass, or metal—to be used as a table on which to rub up the ink; a printer's ink roller squeegee, about 6 in. wide; a sharp penknife; and a supply of waste paper, preferably without printed matter thereon. The design to be duplicated is laid flat on the glass, slate, or tin slab, and with the penknife the design is cut out, leaving the black pattern. A little ink is now rolled out on the slab and worked up to a tacky consistency by means of the printer's squeegee. When it has arrived at such a state that it presents a velvety appearance, the cut-out paper pattern is laid flat on the ink. The squeegee is now run over the top of it, and the ink made to work up through the openings in the pattern, and to ink the upper side of the paper. The pattern is thus thoroughly inked on both sides. A piece of the waste paper is folded in two (book fashion), and the inked pattern raised from the slab by means of the point of the penknife, and laid between the folded sheet. The folded sheet containing the inked pattern is now laid flat on some even surface, and well pressed down and rubbed backwards and forwards with the palm of the hand, thus making two impressions on the folded sheet. The paper pattern is now removed to the inking slab and the process repeated. With care a single original paper pattern will yield some hundreds of impressions before it becomes too frail to be of further use. This method of printing designs is suited to small work, and will also be found extremely useful where, in a large article, patterns repeat themselves. The customary method adopted for duplicating fretwork designs is to obtain a repeat pattern by laying a sheet of white paper over the surface of the cut-out article and applying cobbler's heelball. This method is, however, messy as compared with the above, and is by no means so accurate.

How to do Fretwork.—In executing fretwork, draw out on paper the design full size, then inscribe the pattern selected, leaving a sufficient margin around the edges of the design to give strength where most of the weight hangs from. When the designing is finished, slightly shade the parts that are to be cut away, using Indian ink mixed with a little water. Next the whole should be inked in and then traced to save the design. The wood should then be planed to a smooth surface and the traced copy should be pasted on the board with thin paste; or, instead, the design can be transferred to the wood by means of carbon paper, this being a much cleaner and safer way, but taking more time. To admit the fretsaw, bore holes with a small gimlet in the centres of the parts that are to be cut away, leaving the outside edges until last, as the work is liable to snap in the centre. Then begin on the outside waste pieces and serve them the same way, working with very great care. After all the necessary parts are cut away, the fretwork should be held horizontally with the face downwards over a steam-kettle for a few seconds only; this releases the paper left on the fretwork surface, which should afterwards be rubbed very lightly with glasspaper. Then when the connecting parts are fixed together, the wood will be quite ready for varnishing. Hand fretsaws are very cheap; quicker work is done by means of a treadle saw.

Polish for Fretwork.—Polish for fretwork can easily be made by dissolving 4 oz. of best orange shellac, 1 oz. of gum sandarach, and $\frac{1}{4}$ oz. of gum mastic in 1 pt. of methylated spirit. Carefully strain when dissolved. It is then ready for use, and may be applied by a pad, or as a varnish by means of a camel-hair brush.

Frost-bursts (*see* Pipes)

Fruit, Wax (*see* Wax)

Fuller's Earth

This is a clay robbed of plasticity by silicious material so that it falls to a fine powder when mixed with water. English fuller's earth occurs in a thick deposit of grey clay and marl with occasional nodules of earthy limestone. It gets its name from its use in fulling; that is, in the cleansing, scouring and pressing of woollen goods to felt the fibres together.

Binding Fuller's-earth and Rottenstone.—To bind together rottenstone and fuller's-earth to the consistency of a soft stone, mix the materials with a solution of silicate of soda (1 part silicate to 3 parts water), or, for a very hard mass, mix with lime and the above compound. For a soft mass for polishing purposes perhaps the best material would be sufficient warm glue size to bind the particles.

Testing Fuller's-earth.—There are no regular tests for fuller's-earth, except those of practical application in the industries. But a good sample should be very fine and entirely free from grit. The amount of sand may be tested by weighing out a pound, mixing up with water in a jug, and then allowing water from a tap to run slowly into the jug and away; it will carry with it the fuller's-earth, and in time leave the clean sand, which can be dried and weighed; there should be practically nothing left behind. Fuller's-earth should mix readily with water, but not become sticky or doughy. A dry lump of it placed on the tongue should adhere strongly, and placed on a drop of oil, it should rapidly suck it up.

Fumigating Pastilles

These pastilles are small conical lumps of material which will burn very slowly and give off perfumed smoke. They may be made by mixing together 1 lb. of sandal wood, 1 oz. of vitivert, $\frac{1}{2}$ lb. of cascarilla bark, $\frac{1}{2}$ lb. of gum benzoin, 1 lb. of charcoal, and $\frac{1}{2}$ lb. of nitre, all in fine powder. A solution of gum should then be made by boiling 1 part of gum arabic with 10 parts of water. This should be mixed with the powder to a very stiff paste, which should be moulded into cones and then allowed to dry slowly. Another recipe is: Willow charcoal, 4 oz.; potassium nitrate, 3 drs.; oil of thyme, caraway, rose, lavender, clove, and sandal, 15 minims each. After intimately mixing these with pestle and mortar and palette knife, add sufficient gum tragacanth, made liquid by water, to produce a stiff dough. Mould this into cones 1 in. long and $\frac{3}{8}$ in. across the base. When dry, set them upright on a plate or other uninflammable surface, and light the tip with a match.

Furniture

Doors and Drawers not Opening Smoothly.—Often on replacing heavy pieces of furniture it is found that the doors do not open or close properly, and the drawers will not run smoothly. This is particularly the case with wardrobes, large bookcases, sideboards, etc. It is a mistake to attempt to remedy this by planing the edges of the doors or sides of the drawers to make them fit. In many cases the trouble is due to unevenness of the floor, causing a slight twist in the carcase of the wardrobe or whatever it might be, thus throwing it out of square with the doors and drawers. The best thing to do is to make a couple of wood wedges about 5 in. long, 1 in. wide, and to taper from $\frac{3}{4}$ in. to $\frac{1}{8}$ in.; and by closely observing how the doorway is out of square with the door, it can be ascertained which corner of the carcase requires raising. This can be done by driving the point of the wedge under the plinth as far as is necessary, then cutting off what shows outside. Should one be insufficient, the other end will require similar treatment, but with very large furniture it is sometimes necessary to raise the centre. Another trouble is when, during months of damp weather, drawers will get stuck so tight that it is difficult to move them. This is caused by the wood absorbing the damp, causing expansion, and the sides of a drawer 9 in. deep might easily become $\frac{3}{16}$ in. wider, thus getting tightly fixed between the bearers. To remedy this, they should be stood before a fire or stove to shrink them, when they can be drawn, and in this case they should be very gently and tactfully eased with the plane, and a little french chalk rubbed on the bearers.

False Antique Furniture.—The manufacture of false antique furniture is an industry on a somewhat large scale in America, and probably in Great Britain also. Poplar, bass, and white maple are the most suitable woods for the purpose, though when these are too soft for particular requirements, resinous woods such as spruce and fir are employed; these latter woods, however, possess the disadvantage of warping badly. Sawdust is also largely used,

being reduced to pulp and made into sheets under a pressure so great that all subsequent warping is prevented. The wood is made to assume the particular "antique" colour desired by boiling in dye for one hour. For golden-brown colour, bichromate of potash with bitartrate of potash is used, the wood being afterwards treated with Glauber's salt and ferrous sulphate; for a purple colour, sulphuric acid, Glauber's salt, and cyanine are used; for olive green, the stain last mentioned is employed, Victoria yellow being added to it; for violet, tannic acid and tartar emetic are used, followed with rhoduline violet and acetic acid; for red, caustic soda lye, salt, and alkali red are used; and for terra-cotta, oil of vitriol and Glauber's salt. The piece of furniture, when made up, is given an aged appearance by the alternate application of steam and hot air. The wood is then "filled" with glue size or drying oil containing zinc white, and is next allowed to dry in a heated room, being afterwards put in an oven to receive a glaze. The piece of furniture is now ready to be touched up, this involving the tarnishing of the metalwork by exposure to damp. The article is ready for sale when sufficient dust has collected upon it.

Furniture Revivers.—The following are recipes for furniture polish revivers:—(1) Besides thoroughly cleansing the furniture this reviver leaves a good polish, which is not easily soiled by finger-marks. Mix together spirits of wine 1 pt., vinegar ½ pt., boiled linseed oil ¼ pt., turps ¼ pt. Mix the spirits and vinegar first, shaking well till of a creamy colour; then add the other ingredients, and mix all well together, keeping it tightly corked. Apply with a clean cloth which must be dry, rubbing well in, and polish off with a dry flannel. (2) Thoroughly mix ¼ pt. limewater, ¼ pt. linseed oil, and then add ⅛ pt. sweet oil, well mixed, afterwards thinning with nearly ¼ pt. of turpentine. Apply with wadding or soft rag, wipe off, and finish with soft clean rag moistened (but not wet) with methylated spirit. If the work is very dirty or sticky with wax, it should first be well washed with weak soda and water. (3) To ½ pt. cold-drawn linseed oil add ½ pt. methylated spirits, ¼ pt. good vinegar, and two pennyworth of butter of antimony. Well shake this, and well rub in a little with a soft cloth, repeating the rubbing at intervals for one or two days, when a good polish will be obtained. (4) Warm 3 pt. of turpentine, 12 oz. of Castile soap, 12 oz. of white wax, 4 oz. of butter of antimony, and 1 gill of vinegar over a slow fire. (5) Mix together ½ pt. of vinegar, 1 noggin of methylated spirit, and a tablespoonful of raw linseed oil. Use on a piece of soft rag. (6) Before using this, wash the furniture with a solution of about two tablespoonsful of extract of soap in a pail of warm water. To polish, apply the following mixture with a soft pad: Take ½ pt. each of linseed oil and vinegar, boil them together, and, when cool, add ½ pt. of methylated spirit. This method may be applied to polished or painted furniture. (7) A varnished or french-polished surface may be cleaned with soap and a moist flannel, a moist flannel alone, or a rag wrung almost dry after dipping in paraffin oil. The polish may be revived by rubbing with the following polish: A piece of gum sandarach as big as a walnut is simmered with ¼ pt. boiled oil till dissolved, and, when this is nearly cold, ¼ dr. Venice turpentine is added. Thin this, if necessary, with oil of turpentine. (8) A good renovating medium is camphorated oil, rubbed on very lightly and quickly with a soft flannel rubber. (9) Mix together equal parts of vinegar, sweet oil, and spirit of turpentine. Apply this with a piece of soft flannel, and rub down with a soft silk handkerchief. (10) Wash well with soap, soda, and water; dry well, then revive with raw linseed oil, vinegar, and paraffin oil in equal parts. (11) Mix together cold, ½ pt. of linseed oil, 2 oz. of distilled vinegar, ½ oz. of muriatic acid, 1 oz. of spirit of wine, 1½ oz. of oil of almonds, ¼ oz. of muriate of antimony, and ¾ oz. of spirit of hartshorn. Shake the mixture and pour a little upon a clean rag, rub the furniture well, and finish off with a piece of clean soft rag. The mixture must be shaken each time the rag is replenished. (12) Thoroughly mix together 1 pt. linseed oil, ½ pt. methylated spirit, ½ pt. white wine vinegar, and 2 oz. butter of antimony. Mix well together, shake each

time used, put a little on wadding or flannel, and rub briskly. Wipe off with clean soft rag.

Insects in Upholstered Furniture.—The alva stuffing of upholstered furniture is sometimes responsible for the appearance of insects. Although alva is, as a rule, immune from moth, under certain conditions it will become grubby. Alva is a species of seaweed, and the bulk is imported from the shores of the Baltic and certain parts of South America. When gathered at the proper season and dried in the open air, under normal climatic conditions, it is beyond question a very suitable material for stuffing purposes. Certain traders, however, are in the habit of gathering the weed all the year round, and when natural conditions are not suitable for drying, artificial means are resorted to, with the result that some of the alva is packed green and full of sap. If this is used for stuffing while in this state, mildew quickly ensues, and the growth of the grub is certain to follow. As a rule, alva is only used for the first stuffings and rolls of common furniture, cheapness being its chief recommendation. Flock very seldom gets grubby, but is very susceptible to moth if not ventilated properly. Alva-stuffed furniture affected with insects should be removed without delay, and the insects destroyed by carrying out the following instructions: Procure 2 oz. of naphthalene, which is generally sold by ironmongers under the name of albo-carbon for a certain kind of gas lamp. It is a solid white, sugar-like substance with a powerful smell. Dissolve this in 1 pt. of common benzoline, taking particular care to keep away from fires and naked lights, as the mixture is very inflammable. Freely sponge this mixture all over the infected furniture, working well into the angles and corners with a camel-hair brush. Any inaccessible parts may be syringed. Insects will not survive this treatment if properly done. If the local authorities have a proper disinfecting chamber they will probably undertake the work for the merest trifle over carriage; the fume-chamber process is without doubt the most effectual remedy known. Failing a public disinfecting chamber, proceed as follows: Place the furniture in a spare room or outhouse, and fill all cracks and crevices in the walls, doors, or windows with paper, place in the room an iron pan or shovel containing a few cobs of live coal, throw a handful of rock sulphur on the glowing coal, and then close the door. The sulphur fumes will fill the room, and ought to destroy the insects.

Removing Furniture Paste.—To remove old cream from furniture, try washing with benzoline; or dissolve a small teacupful of common washing soda in 1 gal. of warm water, and if necessary, use a little powdered pumice powder to assist. If expense is not a consideration, a few cakes of pumice soap will suffice without soda water.

Repolishing and Reviving Furniture.—Repolishing, though practically the same as french polishing, calls for more tact if the article in hand is much bruised or faded. To gain a bright, level, lustrous finish on work as it leaves the cabinet-maker's hands is quite different from having to deal with a piece of furniture, dirt-begrimed, broken, or bruised, and entirely different in colour to what it was when first finished. Assuming that we have in hand such an article, it should first be cleansed. For this purpose, dissolve a teacupful of common washing soda in 1 gal. of warm water, and well rub the article, using, if necessary, a little pumice-stone powder or powdered Bath brick, and afterwards wiping quite dry. Any necessary repairs should be attended to, doors unhinged, and all carvings, knobs, brass fittings, etc., removed. Bruises in the wood may be generally drawn up level by means of an old flat file, made black-hot, pressed on several thicknesses of wet brown paper placed on the wood. If a bad bruise, it should be scraped out with a cabinet-maker's scraper and filled up with a mixture of equal parts of resin and beeswax melted together, adding a little dry colour, as Venetian red or umber, to make it match the wood. Having made good all defective parts, wipe over with a rag moistened with linseed oil. In cleaning off any new pieces that may have been inserted, or otherwise removing the already polished surface,

this wiping with oil may have two effects. If the work is old and faded it will appear darker where the polish is removed; on the other hand, if the work is comparatively new a light place will show. This difference in colour will require to be matched by the aid of stains, dry colours, or dyed polish; light mahogany places being darkened by wiping over with strong soda water, lime water, or solutions of bichromate of potash, and light places in walnut by wiping over with one pennyworth of asphaltum dissolved in ½ pt. of turps. If the faded polish or light places are not matched by the above means, body the portion up by passing the polish pad over it several times to prevent the grain rising; then colour up by mixing suitable pigments in 1 part polish and 3 parts spirit. For walnut, add dry brown umber or Vandyke brown with a little black, and apply with a small tuft of wadding or a camel-hair brush. A wavy appearance may be obtained by a tremulous movement of the hand, and a mottled appearance by gently dabbing with a badger softener or a soft dusting brush, such as a sash tool, while wet. For rosewood, mix a little red stain and black, and after allowing the stain to set for a few minutes, smooth down with fine worn glasspaper, and apply a thin coat of spirit varnish. The polishing ingredients are the same as used for new work, but are slightly thinner. A little colour added to the polish improves its effect. A tinge of red stain improves walnut, mahogany, and rosewood; but, if for the purpose of matching any particular portion, a strong colour should be used on the polishing pad, finishing off with clean polish on another rubber. All carved portions, mouldings, and parts difficult to finish with a pad should be given an even coat of varnish. Many articles may be improved by simply applying one or more coats of good quality spirit varnish, of which the following is a recipe: Shellac, 4 oz.; sandarach, 4 oz.; mastic, ½ oz.; Venice turpentine, 1 oz.; camphor, 10 gr.; oil of turpentine, ½ oz.; and methylated spirit, 1 pt. Shake well over a gentle heat and carefully strain through muslin before using, applying it with a camel-hair brush in a fairly hot room. For common goods, such as kitchen furniture, the following will suffice: Shellac, 4 oz.; resin, 2 oz. benzoin, 2 oz.; and methylated spirit, 1 pt. To make a red stain, dissolve one pennyworth of Bismarck brown in ¼ pt of spirit. A few drops added to polish or varnish will give a reddish tinge.

White Furniture Cream.—(1) Wax, 3 oz. pearlash, 2 oz.; water, 6 oz.; melt together then add linseed oil, 4 oz.; turpentine, 5 oz (2) Soft water, 1 gal.; yellow soap, 4 oz.; wax, 1 lb.; boil together, then add pearlash, 2 oz. (3) Melt together 2 oz. of white beeswax and ½ oz. of light resin in ½ pt of turpentine; rub on with flannel; polish off with soft cotton duster.

Furniture Coverings

American Leather.—This is largely used for cheap and medium-class work, and consists of a waterproof paste spread on calico. It can be obtained in almost any colour, and grained or embossed in a variety of patterns. In the upholstery trade it is known as A C leather (American-covered leather). It is difficult for a beginner to lay on properly, being apt to kink and wrinkle unless carefully handled.

Brocades.—These are made both in silk and wool, and the figuring is raised slightly above the surface, which is not piled or cut. They are not very costly, and wear well.

Carriage Cloth.—This is used considerably for covering medium-class furniture and is made in a variety of colours and textures, such as corduroys, Bedford cords, tweeds, diagonals, serges, etc., and varies in width from 27 in. to 54 in.

Cretonnes.—These are printed twilled-cotton fabrics used for upholstered wicker-work furniture, breakfast-room suites, cheap cushions, dust covers, etc. They can be bought in widths of 27 in. upwards.

Damasks.—These are rather expensive, being usually of silk, and richly ornamented.

Hair Cloth or Hair Seating.—This was formerly used to a large extent on ordinary couches and sofas and cottage furniture. The horsehair intended for this cloth is dyed black, and woven in hand looms with a black linen warp. The hair is soaked

in water to make it supple, and put in one length at a time with a peculiar kind of shuttle. The weave is a kind of sateen, the weft or hair in this case being flushed to the surface. It is woven with a raw edge on each side, no selvedge being possible on account of the short length of the horsehair. After leaving the loom the cloth is hot-rolled to give it a lustre. Hair-seating is made in widths varying from 16 in. to 30 in. It is a very strong, durable material, not liable to fade, but on account of its open texture catches a lot of dust. Cheap imitations usually consist of black polished linen warp and weft, both plain and figured.

Irish Terries.—These are not much used at present. Terry has a very rich lustrous surface; the pattern, generally of a geometric nature, is of worsted warp and silk weft. It is a tough, warm material, and about the same price as velvet.

Morocco Leather, or Levant.—This is a natural leather made from the skin of the goat. It is generally dyed a maroon, which is the most common colour used in furniture coverings, and it is usually finished with a rough pebble grain, though samples often met with are embossed in various geometric patterns and richly gilt. It is tough, durable, pleasant to the touch, and soft and pliable. Real morocco leather and roan skins (see below) are sold by the skin, according to size and quality, and the beginner will find them difficult to lay; there is often much scheming to prevent waste, as only certain parts of a hide can be used.

Repp Corduroy.—This is a kind of worsted or woollen cloth of a very stout, close texture. It is sometimes called railway cloth, from the fact that some of the railway companies use it as a covering for carriage seats and backs. It is a very strong, warm material, not expensive, and is made in various colours and patterns.

Roan Skins.—These are manufactured from sheep skins, and are dyed various colours. They are grained in imitation of almost any natural leather. They are often sold as real moroccos, to which they have a somewhat similar appearance; but they are not so durable, though somewhat cheaper. They are sold by the skin. Roan skins and moroccos are not large enough to cover a large chair seat or couch bottom; consequently two or three skins have to be seamed together to get the required length. In this way furniture covered in real skins can easily be distinguished from those in leather cloths.

Saddle-bag.—This style of covering is made from Wilton-pile saddle squares, sometimes called moquette, and plain Utrecht velvet borders. (*See* "Velvets," below.) Saddles can be bought in stock sizes of 18 in. and 22 in. square, and also extra large sizes for couch and settee seats, 27 in. wide. The velvet borders are seamed to the edges of the saddle-bags. Care should be taken in laying on saddle-bag coverings to get the squares parallel with the frames. Half-saddles are often used for small chair-backs and arms.

Serges, Beavers, and Tweeds.—These are not very suitable for furniture coverings, but are largely used in upholstering carriages, etc.

Silk Tapestry.—This differs from other coverings in not being a woven fabric. It is made by a kind of embroidery process, the pattern being worked on a web foundation with needles instead of shuttles. It is very costly, and is mostly used for high-class drawing-room suites. The name tapestry is given to a large number of woven fabrics, some of which are merely cotton prints. A variety known as Gobelin tapestry consists mostly of imitations of paintings, etc., in silk.

Tabinet.—This is a delicate kind of silk, usually water-marked by being subjected to pressure whilst damp. It is chiefly used in conjunction with silk damasks and brocades for Persian bedsteads and hangings.

Velvets.—These embrace a large variety of materials, and their chief feature is their pile or nap surface. Stamped velvet is a plain velvet stamped or embossed in a rotary press with suitable designs. Common mixed goods go through this process, the better qualities, such as Genoa, frisé, plush, etc., being figured in the weaving. There are several mock velvets, known as velveteen and plushette. Frisé velvet is distinguished by its ground being covered

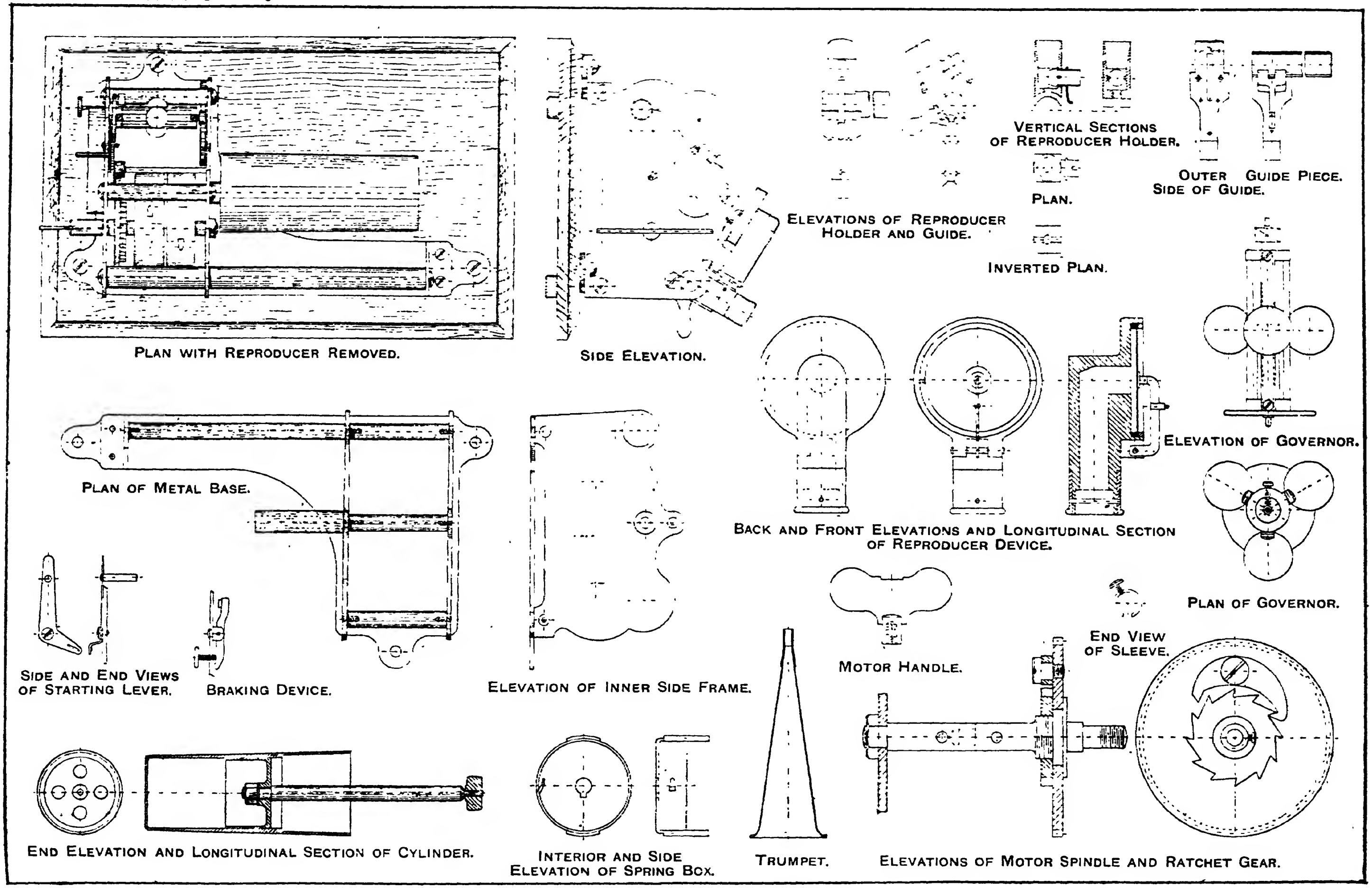
with small loops left uncut. Utrecht velvet is made from mohair, the wool of the Angora goat; it is heavier in pile and texture than the silk and mixed velvets, and is also cheaper. In conjunction with Wilton pile, a kind of carpet, it is often used for making velvet borders for furniture upholstered in saddle-bags. Velveteen is a short pile material, the weft and warp being composed of cotton. Wilton pile—French moquette—is sometimes used, but the heavy pile of the cloth prevents a neat appearance being obtained. Velvets are obtainable in 24-in. widths, and vary in price from 2s. to 10s. per yard.

Furniture Stuffings

Alva.—This is a seaweed from the shores of southern Russia, the Baltic, and other places, and is extensively used as a furniture stuffing. It should be dry, as the damp green portions often seen in a bale of alva are liable to breed vermin. (Fuller information on this point has been given already under the heading, "Furniture: Insects in Upholstered Furniture.") German alva is inferior to French, which is crisper and has more spring in it. The Dutch alva is the cleanest and most free from lumps. None of the vegetable fibres, however, is to be compared with hair, as they do not present the same amount of elasticity. Take a handful of each material and compress it; good hair will expand again on pressure being removed, while the others will only do so to a very limited extent. In use, seats stuffed with fibre become hard and lumpy very soon, while hair retains its spring for a considerable time, though, of course, it eventually becomes matted.

Flocks.—Cotton and woollen flocks were, until a few years ago, almost exclusively used in the north of England for stuffing cheap furniture and beds. Flocks—short stapled, fluffy fibres—are the waste and fallings from the various machines used in preparing the threads for the looms and in finishing the cloth. There are several qualities and varieties of flocks, the best being those made in the operation of raising or fulling fine woollen cloth. The cheapest are the screenings from the cotton-cleaning machines. There are also mixtures of cotton and wool, dyed and in natural colour. Flock makes a nice warm stuffing, but is inferior to the fibres mentioned above for making good edges. Raising flocks are the short fibres torn from the surface of woollen cloth in the process of raising the nap or pile. Cutting flocks are thrown off in the operation of cutting or clipping the face of certain kinds of cloth; these are cheap, usually very short in staple, and enter into the composition of flock wallpapers. Milling flocks are formed in the operation of milling the surface of woollen fabrics. Noils are the short fibres of wool removed in the process of wool combing. Noils and millings are almost pure wool, and command a good price; they are chiefly used for woollen flock beds. Black wool flocks are in many different qualities and colours, and are chiefly made by the combing machines used in wool carding; they are of medium curl, are much used for mattress stuffings, and are often blended with coloured flocks and sold as "red spot fancy," mottled mixture, brown mixture, etc., the name denoting what colour has been blended with the black. White wools are a pure wool flock with a full curl and soft elastic feel, which in ordinary circumstances lasts for years without matting. Teazed wools are a pure wool flock, but are a bad colour, with no curl, and are manufactured from the fluff and sweepings of the mills; they are very cheap and warm. Flock manufacture is usually carried on as an adjunct to a woollen mill, the woollen waste being sorted on large wire grids, which allow the dust and powdered material to fall through. The better qualities are dyed, dried by heat, and passed into a "willowing" machine, which beats and opens all the fibres. They are next passed into a curling machine, and blown out by compressed air, being then packed in 50-lb. bags for the market. The machine used by upholsterers for dressing flocks is known as a teazer or willey.

Horsehair and its Substitutes.—For stuffing, curled horsehair is the best material to use, but it is rather expensive. Several substitutes are sold, the following being



6\. PHONOGRAPH AND ITS PARTS.

he most important: Cocoanut fibre is a plendid material for getting firm edges; t should be of the clean, long-stapled variety, and not powdered. Algerian grass, lyed black, has much the same appearance is horsehair, but is harsh and brittle. New Orleans moss and wild pineapple fibre are also used as horsehair substitutes. When horsehair is burnt it leaves a black ash, whilst vegetable fibres burn to a light grey ash.

Mill Puff.—This is cotton or a mixture of cotton and worsted waste, and is much used in stuffing cheap furniture. It is mostly the screenings or fallings from cotton, etc., thrown down during cleaning and burring.

Mungo.—This is prepared from woollen rags torn into short fibres. Wool extract is very similar to mungo, but has all the vegetable matter extracted by a chemical process. In preparing flocks for the market, they are mixed or blended to produce the different qualities and colours. Cotton flocks, such as teazed or mill puff, are usually packed in bags of 56 lb., whilst woollen flocks are put up in 50-lb. bags.

Other Stuffings.—In addition to the fillings already mentioned, there are special materials for hot climates, the principal of these being paper shavings, wood wool, manna, aloes, etc., the object being to get a loose texture which will admit of more perfect ventilation.

Furniture Trimmings, Springs, Webbings, etc.

Banding.—This is very similar to gimp, and is used for much the same purpose. It is made from long strips of covered leather, folded double and pasted fast at the back, and can be got to match any colour of leather used in upholstered work.

Buttons.—These may be had to match all kinds of furniture coverings. They are packed in cardboard boxes, which contain one gross.

Gimps.—These are used to give a finish to the tacking rebates in upholstered work, and are generally ½ in. wide. The kind used for hair-seated work is black polished linen, either plain or figured. Scroll gimp is a kind of thick silk twist in zigzag form, stiffened by coarse threads running through it, and is used on velvets, plushes, etc. Gimps are sold by the gross yard wound on a card.

Hessian.—This is a coarse jute cloth, and is used as underlinings, first stuffing, etc. The manufacture of this cloth forms the staple industry of Dundee in Scotland. It is made in many varieties and widths; that known as spring hessian is a very strong cloth, about twenty picks to the inch, and weighs 10½ oz. to the yard, 40 in. wide. The coarser kinds, such as scrym, are used as underlinings and first stuffings.

Springs.—Wire spiral springs have the diameter of their centres half that of their ends, the free ends of the wire being coiled inwards, to prevent cutting the coverings. Sizes from 4 in. to 12 in. are obtainable, They are made of different gauges of wire to suit various purposes; 4-in. springs are of No. 12 gauge, and the 12-in. springs of No. 6 gauge. They are secured to wood spring-rails in sofas, etc., with wire staples put over the bottom coil, and are tied or stitched with twine to furniture which has webbed foundations. Old-fashioned springs sometimes met with are found to have the free ends tied down to the first coil by lapping with fine rose-wire. This method results in a certain amount of roughness, which is liable to cut the underlinings unless well lashed with cording. Springs are so cheap that it will not pay to lap the ends by hand labour; but should a spring need shortening for some special purpose, use a pair of strong round-nose pliers, care being taken not to buckle the spring.

Twine.—Upholsterer's twine is a special twine, very strong and tough, and sold in ¼-lb. and ½-lb. balls. Good twine should not break when pulled in use. Twine used in mattress making is of two kinds; one, the thicker of the two, is tufting twine, and the other stitching twine.

Wadding.—This is cotton or cotton-waste very finely carded to give it a soft, fluffy appearance. It is gummed to tissue paper. The grey wadding is the kind mostly used by upholsterers.

Web or Webbing.—This is strong coarse braid composed of cotton-wool alone, or mixed with linen woven plain or tabby,

and can be obtained in rolls of 18 yards. Spring web is very strong material made of linen, with a pointed twill or herringbone pattern running through it. Webbing is used for spring seats and other light work. For backs, etc., not intended for rough wear, a cheaper variety, known as German webbing, is used, but not in good work, in which webbing forms the foundation for the whole job. If poor material is used, the work sinks and bags quickly.

Furs

Cleaning Furs.—Try one of the following methods: (1) Rub with hot roasted bran, allowing the bran to enter the fur well. Then shake the fur and well brush. (2) Moisten bran with hot water and well rub it into the fur with a piece of clean flannel. Now take some dry bran and a clean dry flannel and rub this well in until the wet bran and the fur have become dry. To remove the bran, give the fur a good shake, a sharp but light beating with a cane, and brush with a soft brush. (3) Mix and heat in an oven equal parts o flour and fine salt, and thoroughly rul the hot mixture into the bottom of th fur. Now well shake the fur, then throw it over the back of a chair, fur side upwards and brush out any of the mixture left using the point of a soft brush, and giving sharp "dabs" so as to get to the bottom of the channel formed by the parting o the fur, blowing well all the time. (4) Make a thin paste of light carbonate o magnesia and petroleum spirit; brush this well into the fur until it is saturated; then allow to dry thoroughly, away from any light; afterwards brush out the powder. Any stains still left in may be removed by applying a little ammonia and soap on a rag, followed by clean water, but the fur must not be wetted more than is absolutely necessary, and it should be dried with hot flannel. The appearance of the fur will be much improved by careful combing with an ordinary hair comb.

Dressing Fur Skins.—This is fully described under the main heading "Skins."

G

Galvanising

In galvanising, metal is coated with zinc by being passed through a bath of the molten metal. Zinc for galvanising purposes may be in ingot form or as waste cuttings from sheets; these are melted by heating, the metal being covered with sal-ammoniac and coke dust to prevent, as far as possible, oxidation of the metal. The melting bath is usually of thick iron, built into a brickwork setting, and beneath it there should be left sufficient space for arranging the firebox or furnace in which the fuel is placed to heat the bath. The articles to be galvanised are not usually heated before being immersed in the molten metal. Newer methods of galvanising are (*a*) the electrolytic, in which the zinc is deposited by the action of an electric current, and (*b*) the Sherardising process invented by Sherard Cowper-Coles, in which the metal is heated in a closed iron vessel in the presence of zinc dust.

Garden Frame, Glazing (*see* Glazing)

Gas

Bunsen Burner Lighting Back.—No Bunsen or air burner is suited to be turned down very low, as it is sure to light back. When lighting back takes place, a flame will still show at the ordinary holes, but it will not be an atmospheric one. If the burner is to be turned down most of the time, a band of metal should be put round the air holes, so that the supply of air can be reduced when the gas is turned down, thus securing the proper mixture of gas and air—namely, 1 of gas to ·2·3 of air. The band can be raised above the air holes when the full flame is required.

Freezing of Gas-pipes.—To prevent the freezing of gas-pipes, a German method is merely to insert a wider piece of pipe just where the conduit issues from the ground or wall. For a conduit of a diameter from $\frac{3}{8}$ in. to $\frac{1}{2}$ in., an 8-in. or 12-in. length of pipe 1 in. in diameter is sufficient. The deposition of the water particles contained in the gas, which on leaving the works have a temperature of about 10° C. (50° F.), naturally takes place just where the gas is subjected to the most abrupt change of temperature; that is, on its issue from the ground. If the external temperature is sufficiently low the deposited water immediately congeals and clogs the conduit. As soon as the gas has acquired the temperature of the conduit the deposition of water and congealing cease, and this is said to be the case a short distance beyond the first cooling point. Therefore, there should be no congealing beyond the inserted wider piece, and this piece is wide enough to accommodate a thick ice-crust and still to leave a free passage for the gas. As a matter of fact, the principle of this method is employed in street lamps with success.

Incandescent Burner Lighting Back.—Lighting back of an incandescent gas burner is generally due to bad design somewhere. Such burners will, perhaps, work well enough for a time, but after use they rapidly get unsatisfactory. The only cure for this trouble is the separation of the various parts of the burner, and the insertion of a piece of finer gauze in place

of the piece that is provided; or a second piece of this wire gauze may be inserted in the head of the burner. The gauze is intended to act in the same way as in the safety lamp, and prevent the passage of the flame through it, owing to its power of rapidly dissipating the heat of the flame. (*See* "Bunsen Burner Lighting Back," above.)

Insects in Incandescent Burners.—There is on the market a device that will prevent moths or other insects entering the interior of incandescent mantles. A. E. Podmore and Co. manufacture a lamp which has an insect-proof and dust-proof burner, and which obtained a medal at the Smoke Abatement Exhibition in 1905. This is of the self-intensifying type. For the ordinary C burner chimneys, the Welsbach Incandescent Lighting Co. sell what they call a ceiling protector in metal (enamelled) or porcelain, which has fairly small perforations, and should keep out all except the smallest moths. If the holes are too big, a piece of metal wire gauze could be inserted inside the protector to prevent the ingress of insects. Where globes with lateral air holes are used, air-diverting cones costing 1d. each should be fitted, to prevent the air and moths entering by the under side of the burner.

Lighting Gas Jets by Electricity.—Various methods of lighting gas jets by electricity have been invented, but such methods are costly, and are devised to save labour. In some instances they are necessary, as for lighting gas jets in lofty rooms and domes, but they are not necessary in a workshop. The most simple device is composed of a battery, induction coil, a line leading to all the burners, and a special piece of mechanism attached to each burner for turning on the gas by hand and causing a spark to pass across the jet. There is also an arrangement for lighting a number of gas jets from one point. The same battery, coil, line, and lighting devices are required; but a separate line goes to each burner, and is operated by a separate push.

Roaring of Incandescent Burner.—This points to incorrect proportioning of the gas and air. Try turning down the gas to, say, two-thirds the full supply, and, if this removes the roaring, then by burnishing reduce the size of the holes where the gas emerges in the nipple. The gas cock should always be turned on full, so that the full pressure is obtained at the nipple.

Testing Incandescent Mantles.—To test an incandescent gas mantle before using it on a burner, the "Plumber and Decorator" gives the following hints. When looking at an incandescent mantle, it must have an absolutely conical shape without any indentations or uneven lines. Perfectly conical mantles are generally burned off by hand, and thus each mantle receives careful individual attention. Imperfectly shaped mantles are generally treated by machinery, and may be put down as second quality, or "job." The next proof of the quality would be to examine a mantle thoroughly and see if the fabric contains any uneven perforations, which are caused by a low quality fabric. If such are discovered they may be put down as "seconds." Good quality mantles which contain a full proportion of rare earth should have a great deal of resiliency in them; that is to say, if they are lifted out of the box and put down on a flat surface they will stand a slight pressure of the finger without injury, and rebound to their original shape. First-quality mantles will always be found very even round the head, and will stand a great deal of vibration even after having been burned off. Such mantles should burn at least 200 hours without losing any candle-power. Reputable manufacturers will always guarantee their mantles to burn a certain number of hours, and to contain a certain quantity of thorium and cerium.

Gas Stoves

Cleaning Burners.—To clean gas-stove burners badly incrusted with grease, boil them in strong lye water, or, in very bad cases, heat them to the point of redness over a fire. In heating burners to clean them, extreme care must be used to prevent them overheating, or they will be ruined.

Cleaning Gas-cooking Stoves.—These must have particular attention if the best results are to be obtained, and this is especially true where they are in constant service. Such liquids as milk or coffee should be

watched to prevent boiling over, which causes the burners to be clogged, and the iron or zinc linings to be corroded and rusted, they then having a stained, unsightly appearance. About once or twice a week, according to the use of the range, the burners should be lifted out, turned upside down, and lightly tapped to knock out any dust or soot lodging in them. With a hat-pin pick out any particles that resist tapping. When not in use, the stove should be covered. Keep it clean by rubbing with a dry cloth, particularly the oven floor and racks. When anything flows over and burns, or when parts get greasy, thoroughly scour with soap and warm water, and wipe dry with a clean rag. Gas stoves kept well polished are not likely to become rusty; but should they get so, scour with paraffin oil and fine emery.

Cleaning Gas-heating Stoves.—When the asbestos becomes discoloured or blackened from the gas smoking, the feathery fibre should be sprinkled with common table salt, and the gas then lighted. This soon burns off the deposited soot, and the mineral then resumes its natural whiteness. It happens, too, that the tiny apertures through which the gas flows become gummed and partially filled in; when such is the case, run through the holes a hat-pin or a round toothpick, and it will readily free them; but be careful in doing so not to broach out the holes larger than they were originally.

Gas Fire.—The best gas fire is obtained by a large number of small jets so arranged that each jet will be fed with pure air, and that the burned gas from one jet cannot become mixed with the fresh gas issuing from another. A gas fire should have a supply of air in addition to that which is obtained through the mixer. It is impossible to supply enough air through the mixer to secure complete combustion, and one of the most common errors in setting gas-burners is the attempt to exclude all other air. On the other hand, if an excess of air is supplied it will unduly reduce the temperature of the products of combustion. It is a mistake to attempt to "hold the heat back" by tightly closing the damper in the smoke pipe. When this is too tightly closed, the poisonous products of combustion are retained too long in the furnace and poison the fresh gas issuing from the burner.

Gas Fire Logs.—Gas fireplace logs, after having been used for several seasons, are liable to lose their efficiency, fail to radiate heat properly, and to give off objectionable odours of the gas. When newly purchased, the asbestos fibres are quite long, from 1 in. to 1½ in. in length, but after being used for a while they become broken and even entirely worn away in places. The gas, in such a case, instead of heating these fibres to incandescence and radiating its heat therefrom, passes away into the air more or less unconsumed. To remedy this, take an old knife or putty knife and scrape off all the asbestos from the face of the log. Get 1½ lb. of asbestos wool, which will be sufficient for a large surface. Then get about a pint (or pound) of silicate of soda, which is a mucilage, and is used to cement the asbestos to the fire face. Pour out a saucerful of it and spread out the asbestos on a paper ready for use. The fire surface having been cleaned, take a brush and cover the whole surface of the iron with a coat of silicate, taking care to keep the hands clean and dry. Pick up a pinch of asbestos, dip it lightly in the dish of silicate, and, beginning at the top of the log, stick it on, being careful not to cover up the small flame or gas holes. Repeat this, pinch after pinch, in a row across the top, then another row just beneath, and so on across the plate, row after row, from left to right and top to bottom, until the whole surface is covered. Put the asbestos on as thick as it is possible to apply it. The gas can be turned on and lighted at once; do not wait for the silicate to dry, as the heat cannot hurt it. Wherever gas flames come through the little holes, open them with a pointed wire or sharp needle. After the silicate is dry the loose fibres of asbestos can be shaken off by lifting the log from side to side.

Proportions of Gas and Air.—If a burner secures the combustion of all the gas which passes through it without the production of carbon monoxide, it has done all that can be done. Talk about burners which burn large quantities of air is all nonsense. A cubic foot of gas in complete combustion

combines with a fixed quantity of oxygen. This quantity cannot be increased or decreased. If the quantity of air supplied is insufficient, part of the gas will be unburned. If the air is supplied in excess of requirements, the excess of air will not be used. If more air is mixed with the gas than required, combustion will be imperfect, and part of the gas will be unburned. A perfect gas flame is a clear blue and perfectly transparent. A white or yellow flame, or a milky blue flame, indicates imperfect combustion. Sometimes a gas flame seems blue, but by holding an object on the other side it will be found it is not transparent. This indicates imperfect combustion. If the flame "blows" or "lifts" away from the burner, it shows too much air, and consequently imperfect combustion. If the fire "streaks up" in long ragged flames, there is imperfect combustion. If any portion of the burned gas mixes with the fresh gas, it poisons the latter, and there is imperfect combustion, for a small amount of carbon dioxide mixed with gas renders the whole mixture incombustible.

Right Kind of Flame.—The proper flame in a gas stove Bunsen or atmospheric burner is one in which each separate jet at each hole seems burning alone by itself, not impinging or touching at any point the jets adjacent to it. The flame burns with a greenish cone in the centre of the jet, the cone having the appearance of a vigorous swirling motion, as though the envelope of flame was endeavouring to force the green cone down through the hole from which it issues. There is an idea that there should be a large mass of blue flame above the burners, but the better efficiency of the flame just described can be demonstrated by heating to boiling point a small pan of water over the blue flame, carefully noting the time required, and then repeating the operation with the same quantity of water over the burner adjusted as above described, again noting the time.

Rubber Connections.—Gas-stove dangers are largely increased when the supply connection is of rubber tubing. One of the United States fire underwriters' associations has investigated the matter, and has come to the conclusion that rubber-tube connections are the cause of a large proportion of gas conflagrations, and the association has consequently forbidden the use of such tubing except in laboratories. It is stated that the best grade of rubber hose does not contain more than 15 per cent. of Para rubber, that other grades contain but 3 to 7 per cent., and that poorer grades are made from cloth covered with pitch. It is asserted also that flexible metal tubing is not always reliable. When a leak in rubber tubing is ignited the tube is quickly destroyed, with results not hard to conjecture. The cock at the beginning of the tube is the one that should always be turned off rather than the cock at the stove itself. The association has found that gas stoves mounted on wooden surfaces often char the boards and finally ignite the wood, even asbestos or metal covering not preventing the wood from charring.

Gelatine

Bones, or the cuttings from calf skins, finer portions of ox hides, etc., may be used for making best gelatine, but must be fresh and free from decomposition. The bones are dried, broken small, and packed in a wire cylinder, which fits in a cylindrical iron boiler closed with a lid. The cylinder may be covered with a flannel bag for the purpose of clarifying the gelatine solution. The bones are steamed for a short time while water is percolating over them, and the fatty matter may be run off with the hot water. When no more oil appears, the water is turned off, and steaming is continued under pressure. The gelatine percolates through the flannel bag, and from time to time the solution is blown off. The gelatine solution is poured into shallow tinplate moulds or on to slate slabs, and, when set, it is cut up with a knife and dried on wire netting in a hot room or under sheds in the open air. Hide cuttings are first treated with an alkaline solution until somewhat softened, then washed with water and treated with sulphurous acid in a closed chamber until bleached; they are next steamed at 150° F. until all the gelatine has dissolved out. The solution is allowed to clarify by standing while it is

kept at a temperature of 100° F. The clear solution is poured off, moulded on slabs, the cakes washed with water to remove free acid, the gelatine again melted down, poured on slate slabs, cut up, and dried.

Clarifying Gelatine.—Gelatine solution may be clarified by adding to it a small quantity of alum; add afterwards some bone-black, stir well and keep warm for a few hours, then filter through flannel bags till clear. If the gelatine is for culinary purposes, instead of the alum, use white of egg. If the bone-black (animal charcoal) is of good quality it will both clarify and lighten the colour of the gelatine.

Gelatine Capsules.—To make gelatine capsules, a mould and cores or plugs to fit will be required. The mould should be brass, but a wood one might serve for trial. It should have several (say two dozen) holes bored in it, each hole having the diameter and depth of the capsules required and being rounded at the bottoms. The plugs should be made $\frac{1}{16}$ in. less in diameter, but of the same shape. The gelatine should be dissolved in about an equal quantity of water and, while hot, poured on a polished marble slab and allowed to cool. When set it should be cut into convenient sized pieces, allowing for shrinkage, the amount allowed being determined by experience; the pieces should then be dried in a warm place. Previous to moulding, the gelatine should be softened by steaming, placed over the holes in the mould, and forced in by the plugs. After about an hour the gelatine will be set; the plugs may then be removed, the excess of gelatine shaved off with a sharp knife, and the cases shaken out. The capsules are usually double, one sliding within the other; this will necessitate two moulds, one with holes about $\frac{1}{16}$ in. smaller than the other. If wood moulds are employed they should be oiled to prevent the gelatine sticking.

Gelatine Capsules, Cleaning.—To clean gelatine capsules, fill a box of 6-oz. to 8-oz. capacity one third full of clean, dry salt, and in this shake the capsules for a few seconds; then pick them out or sift the salt through a small sieve. One charge of salt will clean about three hundred capsules.

Gelatining Showcards.—There are several methods of gelatining showcards, but the following will be suitable. Nelson's clear gelatine is dissolved in water. The quantity is immaterial, and can best be determined by experiment. There should only be sufficient gelatine to make the liquid look like dirty water. While applying it to the paper, which may be done with a large flat brush, it must be kept warm. A nice even coating must be given, and the sheets laid aside to dry. As the liquid is very thin, care must be taken not to put on too much, or it may dry in pools, and thus have a dirty appearance. After the sheets are dry, they are put into an alum bath—that is, water in which alum has been dissolved. Allow to remain for a few minutes, and again lay out to dry. Sheets of plate glass or ferrotype are now made thoroughly clean, rubbed over with French chalk or Castile soap, and well polished with a clean rag. The gelatined sheets are then put into water, and allowed to get well soaked. A glass plate is put into the water, one sheet placed upon it, face to the glass, and both carefully lifted and allowed to drain a little. It is laid on the bench, and a rubber roller passed lightly over it several times, working outwards from the centre, so as to get all the water out and to give good contact to the glass plate. The plate should now be stood on end to dry in a warm room or in a current of air. When thoroughly dry, the sheet will peel off the glass, and will have a bright and shining surface. The sheets are afterwards mounted on cardboard if necessary. Varnishing gives better results than gelatining.

Gesso Work

The composition used for gesso decoration can be obtained from most shops that supply artists' materials. There is no fixed formula by which it is made, operators being thus at liberty to vary the proportions and to add any ingredients or colour pigments that may suit their fancy. One preparation is made by simply mixing plaster-of-Paris with thin, freshly made glue and a small percentage of glycerine. In another, whiting

is used instead of plaster, made up as follows: Whiting, glue, gelatine, boiled linseed oil, and powdered resin are mixed while warm to the consistency of thick paint. The gelatine is melted in hot water, the whiting meantime being soaked in cold water, till soft; then, after the surplus water is poured away; the whiting is added to the gelatine, and the whole stirred in a pan over the fire or stove, adding the other ingredients and mixing till thoroughly blended and free from lumps. Gesso ornamentation is largely applied to frames. The frames to be decorated must be cleaned up perfectly smooth, and coated with glue size at the parts where the ornamentation is to be laid on. The composition is then spread on by means of hog-hair flitches, building it up higher where required by laying on successive coatings. Trace the design on the wood first, and use the composition so thick that it will not spread beyond the lines. The gesso may set in a few minutes, or its hardening may be retarded for half an hour, according to its nature. By the skilful handling of brushes alone, much useful work may be done. On the other hand, if allowed to become quite hard, it may be cut, filed, or otherwise rubbed down into many decorative designs. As regards the finish of the woods, oak frames may be stained a dark colour, which is fixed by an application of French polish or thin spirit varnish, the whole surface being afterwards dulled down. The ornamentation is sometimes slightly stained, the stain being rubbed off the sharp or prominent portions, thus giving an antique effect. The stains may be a dilute ebony stain, or Vandyke brown mixed in dilute liquid ammonia; these will penetrate well into the wood.

Gilding

Book-edge Gilding.—The whole process of book-edge gilding is here summarised. After the edges have been cut, the book is placed between gilding-boards (which are the same as backing-boards, but straight on the upper edge), and screwed up tightly in the lying press. The edge is now scraped with a steel scraper to make it perfectly level, and a sponge, dipped in a mixture of Armenian bole or household blacklead and water, is passed over it, the surface next being brushed dry with a soft boot-brush. Armenian bole is a red friable earth, to be had from the druggist. Gold-leaf is spread out on the cushion, cut to size, and lifted on slips of cream-laid or other hard paper, ready for application to the edge when this is sized. Pass the paper over the hair of the head, and apply it to the gold-leaf, which will adhere and may be lifted. The size is simply white of egg and water. To prepare it, break a fresh egg, and allow the white to drop into a wide-mouthed bottle large enough to contain a pint of water, but be careful to keep back the yolk. Fill the bottle with water and shake well, so that the white of the egg will become well mixed with the water. It will work better when old than when fresh mixed. The size is applied to the edge with a broad camel-hair brush, and for this some amount of practice is necessary, as passing the brush over any portion a second time is fatal to success. The object is to have a thin uniform film of size over the entire edge. The gold-leaf is now quickly laid on the edge while the size is still wet. Care must be taken to prevent holes appearing, and where the joins occur the leaf must not overlap too much, as this will show in the finished result. The edge must now be left for hours to dry, and is then rubbed down with the burnisher, a piece of laid paper being held between the burnisher and the edge. When this is satisfactorily performed the fleshy part of the hand is pressed over a lump of beeswax, and this is rubbed over the edge to prevent the burnisher sticking. Commence at the left-hand side and burnish across the edge, moving gradually without lifting the burnisher, until the entire edge has been burnished. This may have to be done several times, but always rub with the wax. The burnisher is a flat agate, bloodstone, or ironstone. It is mounted in a wooden handle, and is held tightly between the fingers, the movement being obtained from the shoulder, which presses against the handle. The operation is the same for all classes of paper, whether glazed or otherwise.

Fire Gilding.—Fire gilding is a process for causing gold to adhere to other metals by the action of fire. There are several known methods of doing this, the following being some: (1) Gilding by gold amalgam. Leaf gold is shaken with mercury in a warm bottle until the two metals combine to form a pasty amalgam. Excess of mercury is then forced out of the amalgam by pressing it in a washleather bag, and the remaining thick paste is spread over the cleaned surface of the metal to be gilded, which is then heated to drive off all excess mercury in the form of a vapour. This is a very unhealthy process. (2) Gold plating. A bar of the metal to be gilded is first made clean and bright on all sides, then coated with a very thin film of borax, over which are laid plates of gold to the required thickness; it is next made very hot in a furnace or muffle and the gold plates are caused to adhere to the underlying metal by pressure, whilst hot, in a rolling mill. The gold-coated bar is now rolled down to the required thinness for rings, chains, etc. A similar process, in which borax is not employed, is adopted to coat round bars of silver with gold for drawing into lace wire. The previously shaved bar of silver is coated with several layers of thin leaf gold, next bound up in several folds of paper; the whole is then heated to redness in a charcoal fire, and the gold well burnished with bloodstone burnishers whilst the bar is hot. Metals may be coated with gold by these methods to any desired thickness, and thus a very durable gilding may be obtained. But similar durable coatings may be secured by the electro-deposit process, although this is generally employed when a rich gold appearance is desired with a thinner coat of gold than can be put on by the fire-gilding process.

Gilding by Immersion.—There are several different solutions for gilding by immersion; in fact, a weak solution of chloride of gold may be used for articles of steel, copper, silver, etc. It cannot be recommended, however. A solution for gilding brass and copper may be obtained by converting about 6 dwts. of fine gold into a chloride, dissolving in a quart of water, adding 1 lb. of potassium bicarbonate, and boiling for about two hours. One minute should be given for immersion. Another method, before using the above bath, causes the articles to be dipped into a solution of quicksilver dissolved in nitric acid and diluted with water. Becquerel's gilding solution has been given as follows: Dissolve chloride of gold, 1 part, and ferrocyanide of potassium, 10 parts, in 100 parts of water, and filter. Then add nearly as much of a saturated solution of ferrocyanide of potassium, and dilute with once or twice the volume of water. The following method is of use in dealing with small bronze articles and cheap jewellery: Caustic potash, 18 parts; carbonate of potash, 2 parts; cyanide of potassium, about 1 part; water, 100 parts. Only one-sixth or one-seventh of a part of chloride of gold is dissolved in the water, and the other materials are added and boiled. The addition of chloride of gold from time to time will strengthen the solution, which must be used while nearly boiling hot.

Gilding Cardboard Mounts.—When picture mounts have been cut out with a bevel edge, the only practical method of gilding this edge is by covering it with gold paper. Paper for the purpose, called gilt binding paper, can be had from most stationers or mount cutters. Strips of this paper are carefully cut to size, pasted, put on the bevel, and turned in to the back. Special attention must be given to have the corners neat and to prevent the join from being unsightly. Such mounts are, however, often gilded before being cut out, but this process is beyond the amateur. A blocking press, three brass blocks, and a shaped steel cutter, will be required. One of the brass blocks is simply a frame, which may be of any shape; this is set up in the press, which is heated. The cards are prepared with the necessary size and gold leaf, then blocked in the press, and when the surplus gold is wiped off, a broad line is left on the board. The second brass block is simply a flat piece of brass, smaller than the frame each way by the size of the bevel, say about $\frac{1}{8}$ in. The third block is a larger frame than the first, and has a little larger opening. The three blocks comprise a set. When the gold line or frame has

been blocked on the card, the block is removed and the second or solid block is set up. The large or third frame is arranged on the bed of the press. The card is next placed between these two blocks, and when pressure is applied in the usual manner a deep impression is made, which will bevel the gilded portion, and the card will have the appearance of a flat tray with a gold border. Then the steel cutter, of the exact size of the block which makes the depression, removes the centre. The various blocks and the cutter must suit the work to be done, and if the blocks do not register with each other, very imperfect work will be produced.

Gilding Glass.—See that all tools and implements, such as cushion, knife, tip, jug, and glass, are free from dust or grease. In order to ensure the absolute cleanness of the glass, go over it with whiting and water, and polish with a clean linen rag. For gilding on glass, isinglass and distilled water are used; sometimes a little pure spirit of wine is added, but not necessarily, as the best results can be obtained with the distilled water and isinglass alone; these must be boiled for about five minutes and then passed through a filter of white blotting paper. Three grains of the best isinglass to 6 oz. of distilled water make a good gilding strength. The liquid is then, by means of a broad camel-hair brush, floated upon the glass, which must be placed in a slanting position. While still wet, the gold is laid on from a gilder's tip and cushion, and after it has been allowed to dry it is gently rubbed with a piece of fine wadding and the cracks or joints touched up. A second application of the gold leaf gives more solidity and makes a better job. It is now burnished again with the wadding and bathed with lukewarm water to bring up the burnish, drying with blotting paper. When thoroughly dry, burnish again, and then with a size brush dipped in water, with the heat increased each time, go over the gold again, thus giving it a third bath. It is now again rubbed and finally coated on the back with gilding size, which, when dry, is rubbed with the cotton. It is then ready for cutting into shape, which is done with a strip of wood cut like a chisel. When the letters have been cut, they may be backed with japan gold size or ordinary black japan, or a mixture of the two. For small ornaments such as corners, paint directly on the gold with the japan, and when thoroughly dry, rub off the superfluous gold to leave the gold figures on the glass.

Gilding Glass by the Chemical Process.—Gold chloride dissolved in distilled water is employed for this purpose. The chloride is prepared by dissolving pure gold in nitro-muriatic acid, evaporating the liquid nearly to dryness, dissolving the gold salt in distilled water, then neutralising the remaining excess acid by the addition of soda. The solution should contain 100 gr. of gold chloride in 1 pt. of water, and must be filtered through blotting paper before use. Four-fifths of this gold solution must then be mixed with one-fifth of a solution made by dissolving 600 gr. of pure caustic soda in 1 pt. of distilled water, and filtering it through blotting paper. This mixture is poured on the surface of the glass to be gilded, and the gold reduced therefrom by one of the following reagents. (1) Pass a current of ordinary illuminating gas through 1 pt. of absolute alcohol for one hour, then add an equal quantity of pure glycerine diluted with its own volume of distilled water. From 10 to 15 drops of this mixture will be required to each 10 dr. of the gilding mixture. Add the reagent a moment or two before using, and pour this on the glass surface to be gilded. In a short time the mixture will turn green, and its gold will be deposited in a bright condition on the glass. (2) Chemically pure glycerine, mixed with the caustic soda solution previously described (equal quantities of each), may be employed instead of No. 1. (3) Dissolve 300 gr. of glucose in 7 dr. of distilled water, and apply heat until one-third of the water has evaporated; then mix the remainder with an equal bulk of 90° alcohol. Twenty drops of this reagent will give the gilding a reddish tinge. (4) Dissolve 185 gr. of white sugar in 25 dr. of distilled water, add ½ dr. of pure nitric acid, and dilute the whole with an equal quantity of 90° alcohol; then boil the whole for a quarter of an hour. Two drachms of this mixture to each 10 dr.

of the gilding mixture will be required. (5) Employ 2½ dr. of amyl-alcohol instead of the above. This gives a special brilliancy to the gilding. (6) An equal quantity of cane sugar brandy will produce a similar result. The glass to be gilded must be quite clean and free from spots. The solutions must also be freshly prepared, and filtered free from dust.

Gilding Plush.—To gild on plush, it will be necessary to press down the pile by means of hot irons and heavy pressure; those portions required to be gilt may then be coated with a mixture of whiting and japanner's gold-size, and the gold applied when "tacky."

Gilding Satin.—For gilding on satin, the best results are obtained with gold leaf. In using this, proceed as follows: Fill in the letters with Chinese white; when dry, add a couple of coatings of strong gum arabic. After the second coating has become set (this usually takes about half an hour), cut up the gold leaf on a cushion, hold the strips ready on the tip, and, having breathed heavily over one entire letter, drop the gold on and dab it down well with a pad of cotton-wool. After a few minutes the loose gold may be brushed off with a soft tool, and any faulty places made good by repeating the process of breathing and "laying" with small pieces of gold.

Gilding Steel.—A method of gilding steel, which, though old, has been recommended as being reliable, is the following: Heat a saturated solution of gold in nitro-muriatic acid to dryness, and dissolve the residuum in water to form a saturated solution. Pour this into a separatory funnel until the latter is one-quarter full, and then fill up with sulphuric ether gently, so as not to mix the two liquids. A separatory funnel has two openings, its upper one being closed by a cork or glass stopper, and the lower one being fitted with a stopcock or merely with a cork. Holding the funnel in a horizontal position, turn it round with the finger and thumb, and when the ether is impregnated with the gold, which will be shown by a change of colour, replace the funnel in a perpendicular position and allow it to stand untouched for twenty-four hours, taking care that both of its orifices are closed. Then take out the lower cork, or turn the tap, as the case may be, and allow the dark liquid to flow off, but retain the lighter coloured, which is the gilding liquid. Free the steel from rust and, after polishing it, dip it into the gilding liquid; plunge into clear water and well rinse. Dry with blotting paper, heat to 150° F., and polish with rouge and washleather, or, preferably, rub with burnishers.

Oil Gilding.—To gild in oil, the material on which the gold is to be placed, whether plaster or wood, must be so prepared that its porous nature is removed. Either paint it in oil or size it over until all suction is stopped. On the ground so prepared the oil size must be laid. When the article sized over has been standing some hours, and is so dry that it has only a slight tack, it can be gilded from a cushion with a tip. A few leaves of gold are taken out of a gold book, gently blown out flat on the gilder's cushion (one at a time), and if too big are cut into the shape suited for the work. Each piece of gold must slightly overlap the preceding piece, and be pressed down with a little cotton-wool or wadding to take away the loose gold and to smooth down the gilding. When all the work is covered, it is coated with clear size made from parchment cuttings, boiled slowly on a stove for some hours, and then poured into a jar to cool and set. For producing a burnished gold surface, before applying the gold, coat several times with pipeclay, thinned with clear size; allow each coat to dry before another is applied. This is carefully rubbed down with very fine glasspaper until a perfectly smooth and even surface is obtained, the last application being allowed to remain undisturbed; consequently it has to be flowed evenly and regularly over the work. Then a little weak size is put on a small part, as it quickly sinks into the ground, and while wet the gold is put on it. If the gold is to be burnished, this is done with a burnisher, which is an agate stone in a handle, it being rubbed briskly on the gold when it is dry. This requires great care and not a little practice.

Water Gilding.—Below is a description of gilding a picture frame or similar article by a process which resembles oil gilding

(*see* paragraph on p. 251, so entitled), except that water size instead of oil size is used. First wash the frame with water, applied with a sponge, and let it dry. Procure some water gold size, then make some thin size from parchment, and mix enough, warm, with the gold size to enable it to be worked on the frame with a camel-hair brush. Give two coats, and, when dry, rub over with fine glasspaper. The frame will then be ready for gilding. Cover it with the size, rest it on its edge to drain, and, when dry, dip a pencil in water and wipe off any particles of gold with it. This will give a solid appearance to the gilding. On any parts not covered lay bits of leaf with a dry pencil; then give the whole a coat of clear parchment size. For further particulars see the paragraph "Oil Gilding" on p. 251.

Gilt Work

Cleaning English Gilt Work.—If an oil- or water-gilt surface is rubbed constantly with water to remove dirt, the gold also, after a time, will come away; therefore, in cleaning a gilt surface, it is necessary to apply something that has a quick action. Brush off loose dirt, and brush on clean water to all unburnished parts; constantly change the water. Soft hog-hair tools and camel-hair pencils are used to apply the water. All dust and fly marks should now have been removed, and the work must be left to dry. Obstinate marks should be wiped over with a camel-hair pencil charged with a mixture made in the proportion of 1 oz. of methylated spirit and $\frac{1}{2}$ oz. of ammonia to 1 pt. of water. Rinse the brush in clean water each time it is removed from the work, and squeeze out before re-charging with the mixture. The quicker this part of the work is done the better, and the brush should not be passed twice over parts where the gold may have risen and shows signs of coming off. The burnished portions of the gilt work, if wet has not touched them, may have their appearance improved in a simple manner. Fold a piece of new washleather so that it fits in to the burnished hollows, etc.; lightly breathe upon a small surface of the burnish, and at once push or roll away the dirt and dust with the washleather. Fly marks, generally, may be removed in the above manner, but the rubbing must not be continued at the risk of the gold being rubbed off. As a precaution, hang a tissue-paper screen between the work and the source of light, and this will show whether the operator is rubbing through into the burnished gold-size. Much practice is necessary to avoid taking off the edges of hollows, fillets, etc. Burnished "bubbles" and scrolls are cleaned by gently rubbing with a washleather drawn tightly over the thumb, the gilt work having been breathed upon previously. Cleaned gilt work may be sized to improve its appearance; for ornamental parts, use clear size; for plain parts, ormolu size. Gilders' ormolu size or varnish is made by dissolving 1 oz. of shellac and 1 oz. of elemi in 1 pt. of spirit, or by dissolving $1\frac{1}{2}$ oz. of shellac and a tablespoonful of powdered gamboge in 1 pt. of spirit; strain before using.

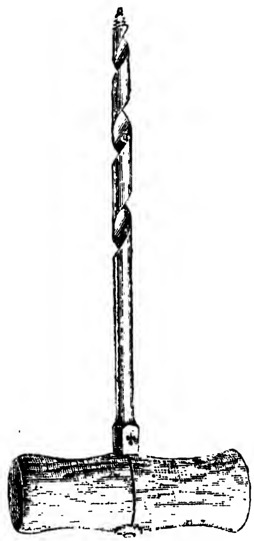


Fig. 367. Twist Gimlet.

Fig. 368.—Point of Shell Gimlet.

Cleaning Foreign Gilt Work.—In cleaning foreign "washable" gilt work, little can be done beyond a thorough brushing with water; obstinate fly marks are removed at the risk of injuring the gold beneath. Marks can be removed from English gilt

work without damaging or discolouring the gold leaf, but foreign gilding is destroyed by such treatment, white spots showing where the marks have been washed off. Short of re-gilding, the only remedy is the application of the very best gold paint; but the use of gold paint on articles exposed to the atmosphere is discouraged, because sooner or later it will turn black unless protected by varnish, and the latter spoils the appearance, giving the gold a brassy colour.

Gimlets

Gimlets are small, screw-pointed hand tools, for boring holes in wood. The ordinary forms are the twist gimlet (Fig. 367)

Fig. 369.—Point of Twist-nose Gimlet.

Fig. 370.—Point of Auger Gimlet.

and the shell gimlet (Fig. 368); but other forms are the twist-nose or Swiss gimlet (Fig. 369) and the auger gimlet (Fig. 370). Gimlets are suitable for boring end grain as well as across the fibres, but are liable to split narrow stuff owing to the wedge action of the screw point.

Glacé Kid Polish (*see* Boots)

Glass

Cement for Glass.—(1) A frequent requirement is a cement for mending heavy glass dishes, which will not come apart on handling, or with hot water. This is not easily obtained, but try the following: Mix 2 parts of fine powdered glass with 1 part of powdered fluor spar, and make into a paste with silicate of soda. Apply very quickly, and tie the parts together until the cement is quite hard. (2) The following is a recipe for a damp-proof cement that will stick glass to glass. Grind together 2 parts of litharge (lead oxide), 1 part of white-lead, 2 parts of boiled linseed oil, and 2 parts of copal varnish. (3) A new cement for glass is compounded with traumaticin (10 per cent. solution of guttapercha or indiarubber in chloroform) and a concentrated solution of water-glass. The joint is very strong, transparent, and is not affected by changes of temperature or by moisture. Traumaticin, as already stated, is a 10 per cent. solution of guttapercha in chloroform, and is used in surgery, in the same way as is collodion, to assist in uniting the two edges of a wound.

Cementing Glass Beads to Wire Pins.—Make both glass bead and pin hot, and apply a little marine glue to the hole in the glass, then press in the pin; everything must be hot, or the pin will not hold fast.

Cementing Glass to Brass.—One of the best materials for cementing glass to brass is Canada balsam. This may be bought from a chemist in the form of a yellow, honey-like substance. To prepare it for cement, place it in a small saucer, and heat in a moderately hot oven for several hours. When cold it should be quite hard. Now break it into small pieces, place them in a bottle, add a little benzene, and put the bottle carefully in warm water. When the balsam has all liquefied, allow it to cool. It should be nearly solid when cold. If this is so, again melt by warming, and apply it to the parts to be cemented; warm these carefully, both before and after applying the cement, and bring them together. In a few days the cement will be quite hard.

Cutting Glass.—A diamond cuts glass not by abrasion but by forcing apart the particles and so forming a continuous crack along the line of the intended cut. The crack having been started, very small force is necessary to send it through the glass, and thus the piece is broken off easily; the crack or cut need only be one-two-hundredth part of an inch deep, and so the application of much force only wears away the gem without doing the work any better. A glass-cutting diamond should be used by one person only, who will always hold it at a certain angle and keep it in good condition.

When a diamond is at the call of anyone, lent to friends, etc., it becomes practically useless, owing to it being used by inexperienced persons. The pitch at which the diamond should be held when in use is indicated by the bevel of the steel in which the diamond is set; this in almost every case should be kept parallel with the glass to be cut. No pressure should be employed when cutting sheet glass with a diamond; but, if a hardened steel wheel is used, sufficient pressure must be applied to break through the hard surface of the glass. If a diamond requires the application of any pressure, it is out of order, and should be reset. In cutting

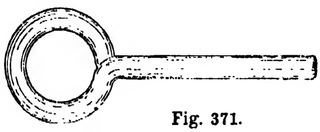


Fig. 371.

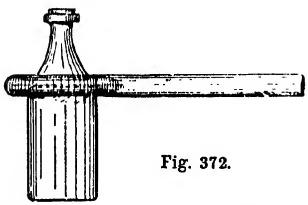


Fig. 372.

Figs. 371 and 372.—Cutting Glass Bottle with Hot Iron.

plate glass, use a large diamond with a firm hand, then with a small hammer gently tap the side opposite to that marked, and the glass will part.

Cutting Glass Bottles.—The following is a simple method of cutting a glass bottle. Procure a piece of $\frac{3}{8}$-in. round-iron rod (thinner would do, but the $\frac{3}{8}$-in. will keep the heat longer), about 2 ft. long, and bend it at one end in form like an eye-bolt, as shown in Fig. 371, making the eye of a size sufficient to slip down over the neck of the bottle to the point where it is to be cut. Place the iron in the fire, and while it is heating place the bottles on the hearth or table near to hand, together with a bucket about three parts full of cold water. Now take the red-hot iron in the right hand, and pass it down over the neck of the bottle (*see* Fig. 372), and press firmly, while with the left hand twist the bottle round for a few seconds, to make sure that the iron touches all round. Then withdraw the iron and plunge the bottle, neck downwards, in the water, and the neck will drop off. With practice, several bottles can be cut with one heating. It sometimes happens that the bottle will crack all right when dipped in the water, but the neck will not fall off, when a slight tap with the iron will be sufficient to part it. When the bottles are all cut, rub down the sharp edges with a stone. Second method: Make a small jet by drawing out a glass tube, or, instead, use the mouthpiece end of a clay tobacco pipe; connect this to the gas supply by means of a rubber tube. Stand the bottle on a table, partly fill with water, and make an ink mark all round it at the level of the water. Now empty the bottle, and with a triangular file make a deep cut on the lip of the bottle and, having lit the gas-jet, place it on the mark: after a few seconds remove the flame and touch the part with a wetted match stalk; a crack will form at once, or after two or three trials. Now place the flame in front of the crack and lead it down the neck of the bottle to the ink mark, then right round the bottle. Third method: This is suitable for removing a bottom from a glass bottle. File a notch round the outside of the bottle at the place required, using a sharp-edged file. This is rather difficult, but after getting through the hard outer skin, and exercising a little care and patience, a notch can be cut round. Then insert the bottle up to the notch in boiling water for a short time; then take out and insert in cold water to the same level. After heating and cooling two or three times the bottom will drop off at the notch. Fourth method: Fill the bottle with linseed oil to the level at which it is required to be cut off, then insert a red-hot poker, being careful not to touch the bottle, and in a short time, it is said, the bottle will part at the level of the oil. Fifth method: The following applies particularly to the cutting of boiler-feed glasses. The length of the glass required having been marked off, tie a piece of string tightly around the mark to serve as a guide. Another

piece of string is then passed once round the glass, but not tied. An assistant holds the glass and one end of the string, which is pulled forward and backward until the glass is hot, when, on plunging in cold water, a clean break will occur.

Decorating Glass.—A home-made device for decorating glass, described in the "Scientific American," is of use for cutting initials, monograms, and ornamental borders or bands on glass articles, such as tumblers, bottles, hand mirrors, etc., with emery powder. The glass must be held stationary by any suitable means, and then all that is necessary is about 3 lb. of medium grade emery and a funnel having a tube from 4 ft. to 5 ft. long and ¼ in. in diameter. The initial is cut through a paper stencil, which is fastened to the glass with mucilage or held in place by rubber bands. The emery falling through the tube and striking on the exposed glass cuts it quite rapidly, and three or four runnings of the emery will form the cut sufficiently deep. The stencil should be a trifle larger than the desired cut in the glass. To cut an ornamental band on a goblet, tumbler, or bottle, the work should be rotated slowly about 2 in. below the funnel tube. The turning, of course, may be done by hand, but this is tedious, and old clockwork can be made to do the turning, or a special device may be constructed from odd material. This device has a suitably mounted spindle, with a block of wood or a large cork on one end to fit snugly in the tumbler, so as to support it. Fixed on the spindle at half its length is a drum formed by a large spool, around which is wound a cord whose other end connects with a fixed double pulley and a movable double pulley, to which the actuating weight is attached. Pierced plates of metal or wood may replace the pulleys, but then the friction will be increased, and there will be more wear on the cord; a short fishing line answers as the cord. The flow of emery may be cut off by a small cork in the funnel attached to a string. The spindle is cranked for rewinding the cord round the drum, the work of the emery continuing during the rewinding.

Drilling Hole in Glass.—A hole may be drilled in glass with a metal drill and a brace, using turpentine freely to lubricate the drill, but the operation will be very tedious. When the hole is cut it may have to be enlarged with a half-round file and turpentine. The following particularly refers to drilling a hole in the bottom of a bottle. Make a drill by heating an old three-cornered file, and place it in the ashes to cool slowly; this will soften it. Then file the end to a conical shape, and heat it again, plunging it into cold water to harden it. Now place the bottle so that it cannot move, and, fixing the file in a brace, rotate it, pressing on the bottom of the bottle. Use turpentine to lubricate the drill. To remove it, work the brace in the reverse direction carefully, or the glass will be broken (*see also* p. 256).

Fixing Glass.—(*See* main heading, "Glazing.")

Frosting Glass.—To give glass a frosted effect, daub on with a sponge a solution of Epsom salts in beer; the crystals will arrange themselves in various forms.

Gelatine and Glue: their Action on Glass.—The action of gelatine or glue on glass is an established fact. A thick layer of strong glue covering a glass object adheres strongly when wet, but on drying may be detached, and then carries with it glass scales of different thicknesses which have been lifted from the surface. The glass now has much the appearance of frost on a window-pane, and has a decorative effect. With gelatine, tempered glass is easily attacked, as well as Iceland spar, polished marble, fluor spar, and other bodies. A sample of quartz, cut parallel to the axis of the crystal, was covered with two layers of fish-glue; when dry it was found that the surface was attacked, and showed a series of striæ which were parallel, rectilinear, and ran close together. In the case of glass the striæ were curved. When certain salts (those easily crystallised and without chemical action) were dissolved in the gelatine, a series of engraved designs of crystalline appearance was produced on the glass. A solution of strong glue containing 6 per cent. of alum gave very fine designs, somewhat resembling moss in appearance; other salts, such as hyposulphite of soda, nitrate and chlorate of potash, produced analogous forms. The best glue for trying experi-

ments is good Scotch glue or Coignet's French glue; the glue must be strong in order that it may get a good grip of the glass. The effect of glue on glass is rather remarkable, but has been known for some time, and was used as a means of producing rough designs on glass. After applying the glue, it should be allowed to set in a cool place (say at a temperature of about 60° F.), and then gradually warmed until the film rises. If the glue is heated too quickly the film may run. In the case of fish glue on quartz, the first layer is thoroughly dried before the second is applied, and the second layer is thoroughly dried before the glue is removed. In this case the drying should be done with artificial heat, say 100° to 150° F.

Glass Bottle-stoppers.—Below is described a simple process whereby ground-glass stoppers which are not quite true may be made to fit accurately. Dip the stopper in water, then in some fine emery powder; place it in the mouth of the bottle, and work it with a rotary motion for a time. At intervals, wash off the emery, dry the stopper, and see if it fits. Continue the process till it does fit.

Glass Bottle-stoppers: Removing.—Place a few drops of olive oil on the lip of the jar or bottle between the stopper and the mouth of the jar, then stand it in a pan of cold water; warm the water slowly until it is nearly boiling, then allow to cool. This will cause some of the air to escape from the jar on heating, and the oil will be drawn in when the jar cools down again. If, on trying the stopper, it is not loose, take the jar or bottle in the left hand and press the thumb firmly against the stopper; now, taking a piece of wood in the other hand, gently tap the stopper. Do not put the jar into hot water, or it may crack; and do not use metal in place of wood for tapping the stopper. A method that sometimes answers is to wring out a cloth in very hot water and wrap it round the neck of the bottle for a few seconds; the sudden expansion of the outer glass may loosen the stopper.

Glass, Gilding (*see* Gilding).

Iridescent Glass.—Glass may be rendered iridescent in a very simple manner and at little expense in the following way: Make a dilute solution of silicate of soda, and, having poured it over the cleaned surface, allow it to dry by evaporation. The rainbow colours will then appear; but on washing with running water and again allowing the surface to dry, the effect will be considerably more brilliant. The unprepared side of the glass can be blackened with advantage; it throws up the colours. The solution should be filtered and dust should be kept away.

Re-polishing Glass Door Knob.—Make a small pad of very fine felt and on it place a little rouge powder. Apply this to the surface to be polished, using the rouge powder slightly damp at first, and afterwards dry. It will be necessary to press heavily on the pad while in use.

Riveting Glass and China.—The art of mending broken china or glass by clasps or rivets of brass wire is eminently suitable for the handyman. A drill, diamond bits, a pair of combined cutting and holding pliers, some brass wire, and a little plaster-of-Paris are all the tools and materials necessary. The drill (Fig. 373) is a steel rod A, worked by a tape E fastened to a piece of wood, which plays up and down. Get a steel rod about 14 in. long, tapering at one end. Sometimes worn-out cotton spindles can be bought very cheap; these answer splendidly, as they are already tapering. Cut off a piece from the end that does not taper, and drill a hole through to take the tape. Turn up a piece of box or ebony, about $2\frac{1}{4}$ in. by 1 in., as shown at B, and drill a hole through its middle slightly smaller than the steel rod, so that it will hammer on tightly. Be careful to make this hole true, or the bob will wobble. Drill first one side at the centre mark, and then the other; or, perhaps, the better way will be to hammer on and true up in the lathe. Now take another piece of the same wood, and turn to about 7 in. or 8 in. long, and $\frac{3}{4}$ in. thick, as at C; drill a hole through this also, but larger than the steel rod, so that it will play up and down easily (this is for the fingers to hold, so as to give motion to the drill); pass the steel rod through this, hammer the ball on to about one-fourth of the rod, tie one end of a piece of tape or leather to one end of the finger-piece (or

drill a hole in each end, and tie the tape in a knot underneath), pass the tape through the hole D in the rod, fasten the other end, and the drill is complete. The drill can be bought ready made if desired. The drill bits (Fig. 374) are pieces of tinplate, fitting tightly on the steel rod of the drill, with a rough diamond point cemented in the small end B. As these require a little practice to set properly, they had better be bought

be repaired. Join the plate, and turn it bottom upwards; the rivets go in the underside so as not to show when hung on the wall, or when in use. Now mark, with a steel point dipped in oil, on both sides of the break and crack where the rivets are to go. Old oil from an oilstone or hone is the very best thing to mark with, as it makes a black spot which is easily seen. Be careful to make the rivet holes exactly opposite each

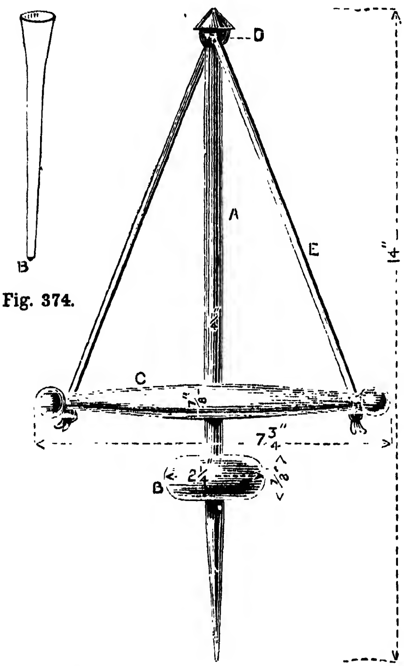


Fig. 373.—Glass Riveter's Drill.
Fig. 374.—Drill Bit.

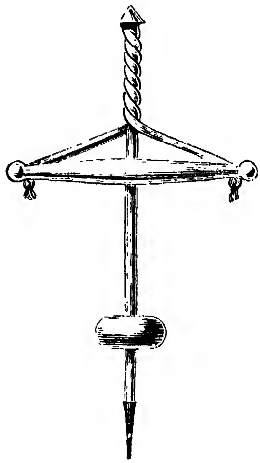


Fig. 376.—Drill with Tape Twisted Ready for Use.

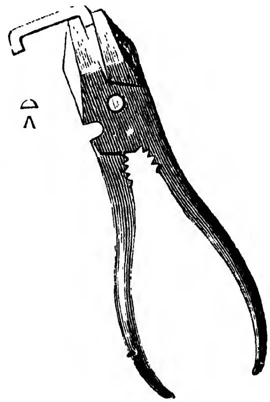


Fig. 377.—Forming Rivet with Pliers.

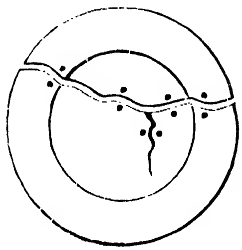


Fig. 375. Broken Plate to be Riveted.

ready made. The brass wire used is about 12 to 16 B.W.G., mostly the latter size, and it must be flattened on one side, either by filing or scraping with an old knife. A quick way of doing it is to hold the brass wire down on the right thigh with the blade of the knife, and draw sharply with the left hand past the knife two or three times, when sufficient will be taken off for the purpose; cover the trousers with a piece of leather before doing this, as the wire gets very hot. Assume that a plate, as in Fig. 375, with a piece broken out, and cracked also, is to

other. Now take the drill, to which has been fastened an appropriate-sized bit (for a small plate, of course, use a small gauge of wire and small bits; for a larger plate, thicker wire, and a larger bit); take one of the pieces of the plate, and having broken the glaze, either with the diamond or a steel drill set in a handle and sharpened on a hone, grasp the wood handle of the drill with the thumb and first finger on the left side of the steel rod, and the second and third fingers on the other side; twist the tape round the rod, as in Fig. 376; press slightly,

when it will uncoil, and, by raising the hand at the proper moment, coil in the opposite direction. It will, perhaps, not be easy at first to get a continuous motion, but it will soon come. It is a similar action to the treadle of a lathe, only performed with the hand instead of the foot. Practise at first without the bit upon a piece of wood. Drill as deep as the article will allow, lubricating with oil. Having drilled all the holes in one piece, proceed in the same way with the other; then take some of the prepared wire, and turn down at right angles with the pliers (Fig. 377) one end about $\frac{1}{16}$ in. or $\frac{1}{8}$ in., according to the depth of the holes, keeping the flat side of the wire underneath (A); place this in one hole, and carefully mark where the bend ought to come; cut off, and turn down the other end. When all the rivets are finished, proceed to fix, when, if properly made, they ought to fit tightly; in fact, it will be all the better if they require a slight tap with a small hammer, but see that the ends are not so long as to prevent the rivets lying flat on the plate. Mix a little plaster-of-Paris with water, and fill up all the holes, and also the cracks, if there be any, and the plate is then finished.

Window Glass.—The two varieties of window glass most extensively in use are known as sheet and plate glass respectively. Glass is made from pure sand mixed with soda and chalk, with the addition of a proportion of powdered glass. Sheet glass is first blown into the form of a large hollow cylinder; the ends are cut off, and the remaining portion is cut down the centre. The flat sheet is obtained by causing the cylinder to unroll in a kiln under the influence of heat, the sheet afterwards being annealed. Plate glass is obtained by pouring white-hot metal (glass) on to an iron table, and then rolling it under heavy iron rollers. Sheet glass is called 15 oz., 21 oz., etc., after the approximate weight per square foot; 15-oz. glass is about $\frac{1}{16}$ in. thick, 21-oz. equals $\frac{1}{10}$ in., 26-oz. equals $\frac{1}{8}$ in., 32-oz. equals $\frac{1}{7}$ in. Roughly, the addition of $\frac{1}{16}$ in. to the thickness adds 13 oz. in weight. Plate glass is made $\frac{1}{4}$ in., $\frac{3}{8}$ in., $\frac{1}{2}$ in., $\frac{3}{4}$ in., and 1 in. thick, that for shop windows being polished so as to make it perfectly transparent. Patent plate glass is made by polishing sheet, or blown, glass on both sides. The care required to polish thin glass in this way, and the amount of breakage resulting, cause it to be very expensive; but it has advantages in the way of lightness and thinness which make it suitable for picture glazing. Sheet glass is made in various qualities, the best being used for glazing pictures, and the commoner qualities for ordinary window glazing. Sheet glass can be easily distinguished from plate or patent plate glass from the fact that waves can be seen on looking along the surface of the glass. The best varieties are free from small air bubbles which frequently occur in the lowest qualities; also the irregularity of surface in the cheapest kinds causes a distortion of anything viewed through it. Sheet glass is sold in crates; the number and sizes of sheets in the crates varying according to the thickness of the glass. Polished plate glass is used for glazing shop windows, making shelves in showcases, etc. Plate glass is ornamented by grinding and polishing. When a polished chamfer is put round the edge of the sheet, the glass is known as bevelled, this effectually improving the appearance, especially when the glass is silvered. The patterns on so-called embossed glass are produced with the aid of fluoric acid. Ground glass is made by removing the surface from one side of the glass, causing it to be translucent, but not transparent. Rolled plate is sometimes made with corrugations or ribs on one surface, and used for glazing lavatories, etc. This is sometimes known as Hartley's rolled plate. Cathedral glass is sheet or plate glass of a neutral tint. In many cases the coloured glass used in forming the pattern for the glazing of front doors and landing windows is known as cathedral glass, this being pieced together by means of lead cames, which usually take some part in the design. In recent years, many different patterns have been formed on one surface of the glass during rolling, and such glass has been given a distinctive trade name. In addition, a glass is manufactured presenting a non-transparent, light-reflecting white surface, of china-like appearance, for use when the reflection of

light is required. A fire-resisting glass is made by embedding wire netting of small mesh in glass, which prevents the windows glazed with it from being broken in the case of a fire, and thus causing a draught.

Writing on Glass.—For sketching on glass, a piece of hard soap or white wax cut to a point answers very well. A suitable crayon for writing on glass can be made by fusing in a cup 4 parts of stearin, 3 parts of tallow, and 2 parts of wax; stir into this 6 parts of minium and 1 part of potash, screw the whole mass up and down in a tube, and cut to a point with a knife. Coloured pencils for writing on glass are described in the "Pottery Gazette." The ingredients are, for black pencils, 1 part of lampblack, 4 parts white wax, and 1 part of tallow; for white, 4 parts of zinc white, 2 parts of white wax, and 1 part of tallow; for light blue, 1 part of Prussian blue, 2 parts of white wax, and 1 part of tallow; for dark blue, 3 parts of Prussian blue, 1 part of gum arabic, and 2 parts of tallow; and for yellow, 1 part of chrome yellow, 2 parts of wax, and 1 part of tallow. The fats are melted and the colour is then thoroughly mixed in. When cool, the mass is shaped in a press.

Writing on Glass: Use of Aluminium.—A method of writing with aluminium on glass is to moisten the latter with vinegar, and then do the drawing or writing with an aluminium point. Fine particles of the metal adhere to the glass, which, when dry, shows the markings in silvery lines that cannot easily be removed by friction. It is frequently necessary permanently to mark glass vessels used in the laboratory with graduations, letters, etc., and "Technics" has stated that it is not so generally known as it should be that if aluminium be rubbed on glass it leaves a metallic streak behind. Pyknometers and certain forms of dilatometers may readily be marked in this manner; aluminium graduations on delicate glass tubes can easily be made, and offer the advantage that they do not produce weakness, as file or diamond scratches do. It is possible that lantern slides could be made by drawing on glass with the aluminium pencil, all that is necessary being to wet the glass and draw the pointed end of an aluminium rod firmly across it. In marking tubes with transverse graduations, the edge of a small sheet of aluminium may be used. Remember, however, that aluminium is rapidly dissolved by alkaline solutions.

Glasspaper

Glasspaper is strong paper coated with powdered glass, made to adhere by means of glue. It is the chief abrading material used in woodworking, and has entirely replaced the old-fashioned sandpaper. The different grades of glasspaper are numbered from 3 to 0 and even finer. To use glasspaper properly, a rubber, shaped as in Fig. 378, is necessary; it is made from a piece of wood to which is glued sheet cork as shown. Glasspaper is folded into three, glass side downwards, and the face of the rubber put on the middle division. The

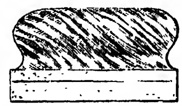


Fig. 378.—Glasspaper Rubber.

rubber is grasped so that the ends of the glasspaper are held firmly on its back and sides.

Glauber's Salt (*see* Soda)

Glazing

Sheet glass is usually fixed with putty made from whiting and linseed oil, while plate glass is more frequently fixed in position by means of beads, either nailed or screwed to the sashes. For cutting glass, glaziers use a diamond fixed in a holder connected with a handle by a swivel joint. The diamond is run along a T-square, the stock of the square having a small notch in line with the blade, so that the diamond can be run completely across the glass to be cut. Sheet glass cut in this way easily breaks off along the cut; but the thicker kinds of plate glass require to be started by tapping with some tool, such as a small hammer, on the side opposite the cut. There are cutters on the market having a small hard steel wheel attached, that can be used for cutting sheet glass. These

cutters have notches of different widths for getting hold of narrow pieces of glass when the cut has to be made close to the edge of the sheet. Glaziers' putty knives sometimes have similar notches in the blade near the handle. Pliers of special shape, gripping at the extreme edge, are also used for removing these narrow strips and for making the cut edge approximately square when the fracture is not a good one. When glass is fixed with putty, the rebate is primed, and a layer of soft putty put on to the edge of the rebate; the sheet is next inserted, and a sprig or two driven in to prevent the glass from coming forward after it has been well pushed down on the putty bed. A fillet of putty is then run outside the glass with a putty knife to make it quite secure. In repairing broken windows, the old hardened putty is removed with a hacking knife, used with a small hammer.

Glazing Counter Cases.—The first proceeding, when glazing counter cases and shop fittings generally, is to black over the edges and sides of the glass to the depth of the rebate. The composition used for this purpose is glue and lampblack applied in a hot liquid state. The bedding material for black work is linseed oil, putty, and lampblack. The inside angle beads are bedded in the glue black. For cases made of mahogany, or any other hardwood, and polished the natural colour, the bedding material would be the same as for black cases, except that the putty would be coloured to match the wood, the inside angle beads being bedded in the glue black the same as for black cases. In all cases the edges of the fixing beads should be blacked.

Glazing Garden Frames.—In the glazing of garden frames or lights, the use of top putties is almost universally preferred. The chief disadvantage of this method for what may be termed horizontal work is the tendency of the top putties to come away from the glass (and frequently from the wood), in which case water is drawn in by capillary action, and if the defect is neglected the woodwork soon rots. But if the woodwork received a preliminary coat of paint in addition to the priming, and the edges of the glass were also painted, and if, in addition, the putties were painted as soon as the glazing was completed, and the paint was allowed to extend $\frac{1}{8}$ in. beyond the line of the putty—the work receiving at least two (three would be better) coats of paint—there would be fewer complaints of leaky glazing and of putties stripping. A method employed in a limited degree—principally by market gardeners, who use a great deal of glass for forcing purposes, and who often do their own glazing—is to omit the top putties altogether, the back putties being carefully laid, and in more liberal quantity than is usual in ordinary glazing; the glass is then thoroughly bedded, and sprigged or bradded to the sash bars, after which the putty is levelled off to the surface of the glass; a line of thick paint, extending $\frac{1}{2}$ in. or so over the glass, is then applied on each side of the bar. This makes a good watertight job, and, as compared with the prevailing method, breakages are more easily replaced, considerably less putty is used, and the rebates in the bars—for new work—need not be so deep. Between the two systems, both thoroughly done, there would be little to choose from a utilitarian point of view, appearance being beside the question, but the gardeners' system should be considerably the cheaper.

Glazing, Putty for (*see* Putty).

Gloves

Cleaning Kid Gloves.—(1) Cut into fine shavings 2 oz. of white Castile soap or curd soap, and boil with 8 oz. of water until a smooth paste is formed; then remove from the fire and add $\frac{1}{2}$ oz. of ammonia, pouring the mixture into a jar. To clean a glove, place it on a glove tree or on the hand, then thoroughly rub with a clean wet cloth on which is placed a little of the soap mixture. Afterwards remove the soap and dirt with a wet cloth, and allow the glove to dry slowly, either upon the tree or on some support, stretching it well from time to time to keep it supple. (2) Use, in the same way as above, a paste made by boiling 1 part of white curd soap with 4 parts of water, and adding a small quantity of ammonia. Any worn

parts may be improved by rubbing in a little magnesia or white French chalk. Rub the glove dry with a clean cloth, and, after removal from the hand, work the glove about to render it supple again, then press with a heavy weight. Kid boots can be cleaned by the same treatment, followed by the French chalk. (3) Cut up 15 parts of dry white Castile soap, add 15 parts of rain or distilled water, and heat on a water bath to a smooth paste; add 16 parts of a solution of chlorinated soda and .1 part of ammonia soap, and mix thoroughly. Apply a little to the glove on a clean flannel, and the dirt should be removed. (4) Suspend the gloves in a tall glass cylinder, at the bottom of which is some strong aqua ammonia. The gloves must not be allowed to touch the liquid, but should be cleaned merely by the fumes.

Cleaning Suède Gloves.—It is a difficult matter to clean soiled suède gloves. However, make a paste of light magnesia and benzene, and, having placed the gloves on the hands, rub the paste well in with a brush; allow to dry, then brush out the dry powder. This will improve the appearance of the gloves, though it is doubtful if it will entirely remove stains.

Cleaning Washleather Gloves. — A good method of cleaning washleather gloves, if they are not much soiled, is by well rubbing with bread crumbs. Another method is to damp about 1 pt. of bran with water, and with this well rub the gloves whilst on the hands. When the gloves are quite clean, get 1 pt. of hot, dry bran and work this into them till they are quite dry. A third method is to syringe the gloves with benzoline and hang in the air to dry. A slight working, shaking, or stretching will remove any slight stiffness. Still another method is to put the gloves on the hands and well wash in soap and warm water. When quite clean (the gloves need not be rinsed), wipe with clean cloths, and finish by working in hot bran.

Glue

The best glue is made from waste pieces and parings of hide, which are soaked for several days in milk of lime, then drained and exposed to the air to dry. This method of treatment prevents the material from decomposing and becoming putrid. The pieces are usually again soaked in milk of lime before boiling, and are then put along with water into a large copper vat with a perforated false bottom, and heated by a slow fire or by a steam-jacket. When the liquid becomes thick and sets to a jelly on cooling, it is run into a steam-jacketed pan, and a little alum is added to it. The liquid then remains at rest for several hours while it is kept warm, so that the suspended matter may settle. The deposit is run off, and the liquid passed through a filter constructed of wood with several thicknesses of cloth at the bottom. The clear liquid is then run into square wooden moulds, which are placed in a cool room for the size to set. When the size has set, it is turned out upon a wetted board and cut into thick cakes with a frame upon which wires are stretched at equal intervals. The cakes are then cut to the requisite size with a knife, and placed upon wire netting in a room through which a current of warm air is allowed to pass. The dried cakes are subsequently dipped in hot water for a moment, and brushed with a hard brush to remove the stains. On again drying, the cakes appear perfectly clear, and have a glossy surface. In preparing glue for use, the beginner rarely takes sufficient pains to produce a satisfactory material. It does not suffice to place the cake glue in water, and at once bring to the boil, because this method produces a glue of but little strength. The proper way of preparing glue is first to break the cakes up small by wrapping in canvas and striking with a hammer. If the canvas is not used the glue will fly into small fragments, many of which will be lost. Put the glue into a clean vessel and cover with clean cold water, allowing it to remain until the next day, when it will have absorbed some of the water and present the appearance of lumps of jelly. Pour off the surplus water, place the glue in the inner vessel of a glue-pot and just cover with water, then keep the water boiling in the outer vessel for two or three hours. To test for thickness, dip the brush in, and if the glue just runs easily without breaking into drops it is

fit for use. Some workmen are able to test the thickness by rubbing the liquid glue between the finger and thumb. A drop of suitably prepared glue, if placed on a cold surface, should quickly become a jelly. If too thin, it will be some time

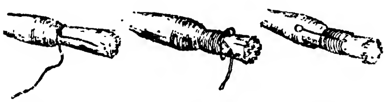


Fig. 379. Fig. 380. Fig. 381.

Figs. 379 to 381.—Tying Glue Brush.

in hardening sufficiently to be handled, and if it is so thick as to harden almost directly and be unworkable with the brush, more water must be added. The inner pot should never be placed on the fire, or the glue will burn and become worthless, the right temperature for heating being that of boiling water. Do not boil the same glue more than twice—it loses its strength. If only a little is to be used at intervals, allow it after the first boiling to get cold and form a jelly; then pieces of the jelly may be cut off and heated as required. Thus a stock of reliable glue is always at hand.

Clarifying Glue.—To clarify a glue or gelatine syrup, decant it into a tall tank and let it rest for several hours, when most of the impurities will settle to the bottom, and, after decanting the glue, the bottoms may be added to the next boiling. If a large quantity of glue solution is to be treated, the heat contained in it will be sufficient to keep it fluid; but for a small quantity a jacketed pan must be used for clarifying. The addition of a very small quantity of alum to the glue solution is beneficial, as it coagulates the flocculent matter and renders it heavier. For gelatine, moist alumina would be suitable as a clarifying agent, or inert white powders, such as china clay or French chalk; these substances should be stirred into the gelatine solution and allowed to settle out. Experiments on the lines indicated should be tried on a small scale first.

Elastic Glue.—(1) Dissolve 1 part of pure indiarubber, cut fine, in 5 or 6 parts of benzine or carbon bisulphide. (2) Soak 1 oz. of glue in water overnight, remo melt down, and add 1 oz. of brown sug 1 oz. of gum arabic, and 4 oz. of wat heat the mixture until dissolved, a apply hot. (3) Dissolve 1 part of shel in 3 parts of strong ammonia.

Fish Glue.—Fish glue is made from refuse, that is, skins, bones, etc., of fish-curing establishments. This refuse boiled with water until it becomes brol down into material that is largely solu in water; the fluid is strained and tl evaporated. Fish glue, owing to the purities it contains, usually remains flu but it is sometimes produced in the so condition, and then appears somewhat l ordinary glue. It always has a deci fishy odour. Isinglass is a fine glue or g tine prepared from the "sounds" or sw ming bladders of the sturgeon, the sh family, hake, and similar fish. Fish g has usually a very strong odour; i may be reduced somewhat by adding little sulphurous acid or by filtration thro animal charcoal.

Glue Brush.—A glue brush can be bou for a penny or two at an oil-shop; if hair is inconveniently long (and this i difficulty that is often met with whe brush is used for enamelling and ot household purposes), the plan adopted painters, who tie the brush with tw to make the hair shorter, may be reso to. Fig. 379 shows how to place the tw which is then bound tightly round the l until the brush is sufficiently short; fi off by passing the end of the twine thro the last two coils, as shown at Fig. 3 and drawing tight. The loose ends are t turned back and secured with a co of tacks to prevent the twine from slip

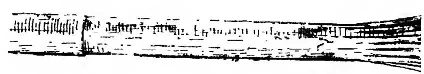


Fig. 382.—Glue Brush made from Cane.

down (Fig. 381). The brush should not put into the glue before it is ready for u and, when the work is finished, it sho be well washed out with boiling wa and put away. From a piece of cane be made a glue brush which has just

right amount of stiffness, and by a rinse in the hot water is immediately cleaned. Take a piece of rattan cane about 8 in. long and scrape off the hard skin to about 2 in. from one end. Soak this end for a minute or two in boiling water, and tease out the fibres with a small flat hammer, with the result shown in Fig. 382.

Glue Pot.—A glue pot has an inner and an outer vessel as shown in the section (Fig. 383). The outer vessel holds the water and the inner vessel the glue. Thus the glue is cooked in a water bath, and burning is entirely prevented. An ordinary glue pot is shown by Fig. 384.

Liquid Glue.—(1) Some liquid glues now on the market are made by boiling glue with a solution of borax or pearlash. Suitable proportions are: Glue 10 parts, water 25 to 30 parts, and borax or pearlash 1 part. Boil for about one hour over a slow fire, or in a jacketed pan, so that the mixture does not burn, and make up to the original volume with water. (2) A liquid glue can also be made by dissolving 2 parts of borax in 19 parts of water; when the borax is dissolved, gradually add to the solution $5\frac{1}{2}$ parts of casein, and stir the whole thoroughly from time to time till it forms a thick homogeneous fluid. (3) Liquid glue may be made by breaking down ordinary glue into small pieces and soaking in strong acetic acid. When the glue has swollen up, melt down by standing the bottle in hot water and add more acetic acid. About one part of glue to five or six parts of acetic acid will be required. (4) Another method is to soak 8 oz. of glue in 10 oz. of water; when the glue is soft, melt down by heating the bottle in water, then add $2\frac{1}{2}$ oz. of moderately strong nitric acid (sp. gr. 1·3), and continue heating until all the fumes have passed away. (5) Heat together on a water bath for six hours, clear gelatine, 100 parts; best Scotch glue, 100 parts; alcohol, 25 parts; alum, 2 parts; and 200 parts of 20 per cent. acetic acid. (6) Another liquid glue is made from glue 100 parts, water 250 parts; boil and add 1 part of carbonate of potash, continue boiling for about half an hour or till the liquid remains fluid on cooling. The boiling should be done in a vessel placed on an iron plate over a gentle fire. (7) Dissolve 6 parts of glue or gelatine in 4 parts of saccharated solution of lime; neutralise the lime with a third part of oxalic acid, and add carbolic acid as a preservative. (8) Lyndetikon, a German liquid glue, very popular in the country of its manufacture, is said to be made in the following way: Soak 5 parts of Cologne glue in 20 per cent. aqueous calcium chloride and heat in a water bath until dissolved, replacing the water lost by evaporation. Another method, and a slightly more complicated one, is to slack 20 parts of lime with 30 parts of water,

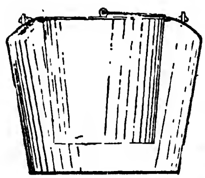


Fig. 383.—Section of Glue Pot.

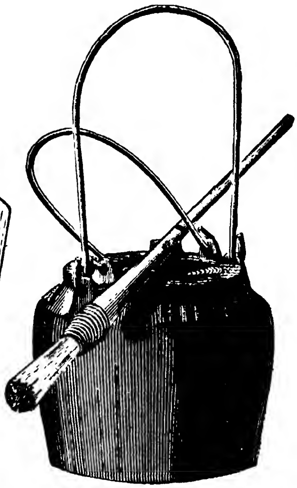


Fig. 384.—Glue Pot and Brush.

and add 3 parts of the slacked lime to a solution of 12 parts of sugar in 36 parts of water; heat the whole to 75° C., and stand aside for a few days, occasionally shaking. A clear sugar-like solution is obtained by decanting, and in this dissolve 12 parts of glue, assisting the solution with moderate heat.

Marine Glue.—(1) The true marine glue is a combination of shellac and a solution of caoutchouc in benzene. To make it, dissolve 1 part of indiarubber in 12 parts of benzene, and to the solution add 20 parts of powdered shellac, heating the mixture cautiously over the fire. (2) Another recipe is: 1 part of caoutchouc

or indiarubber is dissolved in 12 parts of benzine or naphtha with the aid of gentle heat. In from ten to fourteen days, when the solution is complete, 2 parts of asphalt are melted in an iron vessel, and the caoutchouc solution is poured in very slowly, in a fine stream and under continued heating, until the mass has become homogeneous and nearly all of the solvent has been driven off. It is then poured out and cast into greased tin moulds to harden into dark brown or black cakes. This cement requires considerable heat to melt it, and to prevent it from being burned it is best to heat a piece of it in a water-bath until the cake softens and begins to be liquid. It is then carefully wiped dry and heated over a naked flame, under constant stirring, up to about 300° F. The edges of the article to be mended should, if possible, also be heated to at least 212° F., so as to permit the cement to be applied without undue haste and with care. The thinner the cement is applied, the better it binds.

Quick-setting Glue.—The best plan to make glue set hard quickly is to use less water. Agar-agar boiled with water gives a stiff jelly on cooling when only 3 parts of material are present in 100 parts of water; it is quite as stiff as a 20 per cent. solution of glue. A little agar-agar added to glue will make it set hard more quickly; but it is rather expensive.

Spirit Glue.—This is used as a photographic mountant. Only the best glue should be used, as common glue is frequently acid. Break the glue into small pieces, place them in a wide-mouthed bottle, and cover with a sufficient quantity of methylated spirit. The mixture is then well corked and kept in a fairly warm place (such as on a kitchen mantel shelf) for a few hours, frequently shaking the bottle and stirring its contents. If the glue does not dissolve entirely in a day, add a little more spirit. Spread the mountant thinly, and do the mounting as quickly as possible. For mounting prints, the recipe given below is more satisfactory. Soak 4 oz. of sheet gelatine in 16 oz. of water until soft, then melt on a water-bath, or in a large clean glue pot. Add gradually 5 oz. of methylated spirit, stirring rapidly, and finally 1 oz. of glycerine. This mountant is used hot

Testing and Selecting Glue.—French glue is a well-known kind of ordinary glue; it is moderately pale in colour and strong, though not equal to Scotch glue as regards strength. Glue should be of a bright brown or amber colour, free from specks or blotches, which are often caused by the non-removal of lime used in dressing the skins. It should be nearly transparent and with but little taste or smell. Black, opaque, unclean-looking glue is of no use. Very light-coloured glue is often fairly good and of medium price, but the bleaching to which it is subjected sometimes lowers its strength. For some purposes, such as gluing down thin, light-coloured veneers, it is very good, simply because it does not darken the tone of the wood, as the darker glue may do. Glue should be hard and moderately brittle, should not be readily affected by atmospheric damp, and should break sharply, with a glassy, shining appearance. If the glue shivers as easily as a piece of glass it is too brittle to be perfect, but at the same time it should not be tough and leathery. The appearance of the fractured edges is often a good indication, as is also the feel when it is held or rubbed between a moistened finger and thumb. Good glue will not give off an unpleasant smell after being prepared a few days; some of the commoner kinds are very bad in this respect, the odour from them being unbearable. Good glue will not dissolve in cold water, but will swell and assume the consistency of jelly. For this reason some recommend as a test that the glue should be weighed, soaked, and washed in cold water, then dried and weighed again. If there is a loss of weight it shows that some has been dissolved, and according to the difference the quality may be judged. If the water dissolves it as it soaks in, and penetrates for a slight depth only, there is something wrong. Roughly speaking, a glue which will absorb more water than another is the one that is preferable. Glue is sometimes tested by gluing two pieces of wood end to end. Two pieces of mahogany exhibited at Bethnal Green Museum

were tried in this way, and parted under a strain of 504 lb. per square inch. If two pieces of dry red deal be properly glued together side to side, or end to end, the wood will break before the joint if the glue be of fair average quality. The adhesive power of glue is in proportion to its consistency and elasticity after it has been soaked in water for some hours and has absorbed many times its own weight of moisture. For the woodworker's purpose, Scotch glue is the best. In colour it is a clear, wholesome, ruddy brown, not a muddy-looking compound, nor yet refined to gelatine.

Using Glue.—Glue should be used as hot as possible and in a warm room. The pieces of wood to be joined should be warmed before putting together; they should be well fitted so as to get as little glue in the joint as possible; the glue should be well rubbed in with the brush or by rubbing the two pieces of wood together, and the joint should be made close by clamping, tying, or rubbing, so as to squeeze out all superfluous glue. The joint should be made as quickly as possible, and after the pieces are fixed they should remain in a warm place for at least twelve hours. If a joint is broken when it once begins to set, no amount of clamping will make a good job of it; the glue must all be cleaned off and the joint made again. When the wood is porous it will be of advantage to size the surface with some very weak glue. This will fill up the grain and prevent the glue from sinking into the wood when the joint is made. The above applies also to end grain joints, which should be avoided if possible. Before veneering, the panel to which the veneer is affixed should have the surface roughened with the toothing plane to form a kind of key for the glue. Great care should be taken that no dust, grease, or oil gets on the surfaces to be joined, or the glue will not hold. Some woods are naturally of a greasy nature. Take teak for instance; if the wood is not thoroughly dry, the glue will not set on it, but will peel off. Wood of a greasy nature should not be used where glued joints are employed. For such wood, nailed or screwed joints are best.

Waterproof Glue.—(*a*) Add about 1 per cent. of bichromate of potash to prepared ordinary glue, and keep it in the dark till immediately before using. (*b*) Soak a quantity of isinglass in water until swollen; pour away excess of water, and melt the isinglass down by heat; add to it a small quantity of alcohol, and then a solution of 1 part mastic and 1 part gum ammoniac in 3 parts of alcohol. (*c*) The best waterproof glues are those containing rubber or some similar material; but for certain purposes marine glue is very useful; the latter must be melted before using. The materials to which these substances are applied must be quite dry. (*d*) Glue can be made to resist moisture by boiling in skimmed milk in the proportion of 1 lb. of glue to 2 qts. of milk. Particulars of waterproof cements are given under the heading of "Cements: Waterproof Cements."

Glycerine

The manufacture of glycerine in vast quantities is a modern industry, for formerly glycerine was regarded as a waste product. All waste from fatty oils contains compounds of an acid with glycerine. This acid will combine with an alkali, leaving the glycerine in a watery solution, from which it is obtained by evaporation and distillation. Immense quantities of this reclaimed waste product are used in the making of high explosives.

Glycerine Barometer (*see* Barometer).

Milk of Glycerine.—For preparing milk of glycerine, rub up well 8 parts of starch with 115 parts of glycerine, and heat the mixture over a water bath with constant stirring until it comes to a gelatinous consistency. Then add a further 8 parts of starch and stir in thoroughly 400 parts of distilled water. Two parts of tincture of gum benzoin will perfume the preparation.

Gold

Cleaning Gold.—(1) The following solution has been used for cleaning gold articles: Bicarbonate of soda, 4 oz.; chloride of lime, 4 oz.; ordinary salt, 1 oz.; and 7½ pts. of water. The articles are left in this for a short time, being then washed with

spirit and dried in sawdust. If necessary, the solution should be heated. (2) A method of removing stains from gold and silver is to immerse the articles in a solution of $\frac{1}{2}$ oz. of cyanide of potassium to 1 pt. of water. Then brush off with prepared chalk. (3) After hard soldering, and while still hot, dip 18- or 22-carat gold in a weak mixture of sulphuric acid and water. Afterwards wash off the acid with plenty of clean water; then polish up with a brush. Nine- or 15-carat gold must be either gilt or coloured after being made red hot. The heat affects the surface of the metal to a slight depth, and makes it look pale; but an article like the 9-carat stem of a pin can be filed up and burnished again like new after repairing, the false surface left by the fire being removed.

Cleaning Gold Braid.—(1) To clean gold braid, damp the corner of a cloth with turpentine, and rub it on a piece of pipeclay, then apply it to the braid. Next, with a dry cloth or a soft brush, rub the braid briskly. (2) Braid that is only slightly discoloured may be cleaned by beating it with a soft brush dipped in fine whitening, calcined magnesia, or fuller's-earth. (3) If badly spotted and blotched, the stains may be removed by carefully brushing with a brush dipped in a warm solution of potassium cyanide—1 dr. to $\frac{1}{2}$ pt. of water—then in clean warm water. If the braid is of poor quality, all attempts at cleaning will only make it worse.

Colouring Gold.—(1) Gold of 15 carat or more can be coloured by a process that dissolves the alloy from the surface, leaving the articles with a fine frosted surface of pure gold. A paste is made of salt 1 part, alum 1 part, zinc sulphate 1 part, and potassium nitrate 2 parts. This paste is put in a pot, in which the articles are placed. Heat is applied until the paste runs. When a good colour has been obtained, the articles are taken out and, when cool, dipped in weak sulphuric acid and water to dissolve off the remains of the mixture. A wash in weak alkali, followed by ordinary soap and water and a good rinse, completes the process. Dry the articles off in boxwood dust kept warm. The application of the same solution to gilt 9-carat jewellery with a brush, heating the articles on a piece of iron over a lamp until black, and then plunging into cold water, will produce a surface like coloured fine gold. (2) The following pickle has been found satisfactory for imparting a rich dark brilliancy to gold: Alum (powdered) 1 oz., common salt 1 oz., saltpetre 2 oz., and water 10 oz. First wash the gold in warm water to which a few drops (say fifteen to twenty drops to a breakfastcupful of water) of ammonia have been added, using a soft brush and soap. Rinse in cold water, and dry in hot sawdust. Then immerse the article in the pickle for about two minutes, and again dry in hot sawdust. Finally polish carefully with jewellers' rouge.

Gold Lining Cycles (*see* Cycles).

Gold Leaf.—The manufacture of gold leaf is described in the "Journal of Decorative Art," from which the following information is taken. Gold leaf contains about $\frac{1}{30}$ part by weight of an alloy of silver and copper, the metal being melted in ingots about 8 in. long. Steel rollers reduce the ingot to the thickness of a ribbon, and this ribbon is cut into small square pieces and hammered on an anvil until each piece is 1 in. square and about $\frac{1}{750}$ in. thick, the weight being about 6 grains. One hundred and fifty of these squares are interleaved between pieces of vellum about 4 in. square, and a parchment envelope is folded round them and hammered until each piece is expanded to about the size of the vellum. Each piece of metal is divided into four parts, interleaved with gold-beater's skin, and again beaten until the size is quadrupled. Each of the 600 sheets is divided into four, the whole interleaved with gold-beater's skin, made up into three parcels of 800 pieces of metal each, and again beaten until they reach nearly the size of the 4-in. square. There is no further beating, and the leaves are cut to about $3\frac{1}{4}$ in. square and laid in books, each containing twenty-five leaves. Calculation will show that the thickness of the leaf does not exceed $\frac{1}{280000}$ in., and in foreign countries, where beating is carried on still further, the thickness is said to be not so much as $\frac{1}{400000}$ in.

Gold Leaf: Durability.—The durability of gold leaf is great, the unvarnished leaf being able to stand, without cracking or fading, more than a hundred years' exposure to the weather, but only when the leaf is put on with pure oil gold-size. It is not wise to varnish or lacquer gold leaf, as the coating of shellac or other gum fades long before the gold leaf, a fact that can be proved by removing faded varnish or lacquer with a little ammonia, when the gold will be found in a good state. So delicate and fine a nature has gold leaf, that it is almost impossible to coat it with any composition without taking away its lustre; and anything that removes the lustre also removes the very property which gives lasting power.

Gold Plating (*see* Gilding).

Powdering Gold.—The best way of obtaining pure gold in an impalpable powder, so as to retain its full metallic lustre, is to beat it into thin leaf, then mix with honey and grind to powder with a glass muller on a glass slab; after washing with hot water the gold powder is dried. Use the best English gold leaf for the purpose.

Qualities of Gold.—Pure gold containing no trace of baser metal is known as "fine gold," but of course gold is too soft and too expensive to use "fine," so it is alloyed with silver and copper. For the purpose of estimation, the mass of gold alloy is divided into twenty-four imaginary equal parts, termed "carats," and the alloy is known by the number of carats of fine gold that it contains. Fine gold is 24 carat– that is, it contains no alloy; 22-carat gold contains two twenty-fourths of base metal; 18-carat gold contains six parts of baser metal and eighteen parts of fine gold, and so on. Most of the standards of gold are purely arbitrary, but those in general use are five in number: 22 carat, 18 carat, 15 carat, 12 carat, and 9 carat, and, as far as hall-marking is concerned, intermediate grades are not recognised. In testing, if gold falls by ever so little of being 22 carat it is hall-marked as 18 carat, except in the rare case of the 20-carat standard being recognised, as is the case at Dublin. Gold failing to come up to the 18-carat standard, even though it may contain more than 17 carats of fine gold, is stamped 15 carat, and so on down the scale. It is a mistake to suppose that the term "carat" applied to gold has, in the United Kingdom, reference to the weight, for it refers to relative purity only. But much confusion has arisen owing to this term being mixed up by the popular mind with the weight known by that name. This weight is never used by gold- and silversmiths, but diamond dealers use it, and it then has a fixed value of four grains troy, or five diamond grains. The carat, as a weight, is of Abyssinian origin, being the bean-like fruit of the kauri tree; it varies little from the time of its being gathered, and appears to have been used in Africa as a standard weight for gold from the earliest times; *but as a weight for gold it is not used and is not recognised in the United Kingdom.* At Venice is used a weight termed a "carat," this having a fixed value of one one-hundred-and-fiftieth part of an English troy ounce. The English word "carat" was derived from that, although the same value is not retained. The English carat is the twenty-fourth part of any weight, be it ounce, pennyweight, or anything else, and it is therefore only a relative and not a fixed weight. In weighing gold, the legal standard weight was the grain, twenty-four of these comprising the pennyweight, twenty pennyweights the ounce, and twelve ounces the pound, this being known as troy weight. The grain originated from the weight of a grain taken from the centre of a dry ear of wheat. The imperial standard pound troy was established in 1758, and in 1878 this, together with the ounce troy, was legalised further, but the divisions of the ounce were altered, and, instead of the pennyweight and grain, the troy ounce was divided decimally; that is to say, into tenths, hundredths, and thousandths.

Rolled Gold, Filled Gold, and Gold Casing.—"Rolled gold," "gold filled," and "gold cased" mean that the article so described has a hard covering of gold of an appreciable thickness, and anyone selling gilt "trash" under the above descriptions can be proceeded against for fraud. As a substitute for solid gold many devices

are in use. The most common is to make the articles of a base metal—generally brass—and electro-gild them. This process, in the case of articles subject to hard wear, such as watch cases, chains, brooches, etc., is of little use. The coating of gold is soft and thin, and very soon wears off on the most exposed parts. A better substitute for gold is made by coating brass or other hard alloy by mechanical means with a thin layer of hard gold. There are several methods of doing this. Some American watch cases, notably Waltham and Keystone, and some English cases, made by a Birmingham firm, are known as "filled gold." The result is a case made of hard brass, of which all the surfaces, outside and inside, are covered with a fairly thick plate of gold, calculated to wear almost a lifetime. The gold on these cases is so thick as to bear engraving without cutting through into the base metal, and when such cases, weighing 2 oz. or 3 oz., are sent to the refiners to be melted, they frequently produce 15s., showing the actual value of the gold covering. Rolled gold is mostly of German origin, and is made by brazing a plate of gold on a thicker plate of brass, and rolling it out thin into sheet, from which the articles are then manufactured. Rolled gold jewellery is, therefore, the same as the "gold-filled" variety, and consists of hard brass, mechanically covered with a layer of hard gold. The gold covering may obviously be of any quality or thickness. The best is equal to American gold-filled cases. The commonest made is still greatly superior to gilt goods. The cheap jewellery seen in fancy shop windows is mostly of this kind in its commonest form, while in Germany the best rolled gold bears an official stamp—like a hall mark—guaranteeing the quality of the gold covering and its thickness. Gold casing is older than either of the foregoing, and has been practised in England for at least a century. It consists in covering the completed article with a thin gold shell and uniting the two by soft solder. In this case, also, the gold covering is thick and hard, can be engraved, and has a considerable value when the articles have to be consigned to the melting pot. The articles most commonly in use that are gold cased are pencil cases and pocket pens, the bows of watch cases, etc. Much old jewellery, brooches, bracelets, etc., are found to be gold-cased after having been in wear the greater part of a century; their present owners often believe them to be of solid gold, and are undeceived only when the articles are taken in exchange for more modern jewellery, and have to be melted, thus betraying their real character.

Stripping Gold from Gold-plated Ware.—By the following process the gold may be stripped from a gold-plated article, no matter whether it was fire or electrically gilt. Warm up an almost exhausted gold-plating bath, and use the plated ware as the anode. After the current has been active for a short time, the gold will be found to be entirely stripped from the article and is recovered by diluting the stripping fluid with double the quantity of water, and adding a solution of sulphate of iron. The gold will be precipitated in powder form, and may then be melted. The gold may be stripped also by means of a mixture of 10 parts of sulphuric acid, 2 parts of hydrochloric acid, and 1 part of nitric acid, in which it will gradually dissolve. The articles must always be placed in this mixture in a perfectly dry condition. To recover the gold, dilute this acid mixture with from ten to twelve times its quantity of water, and add a solution of iron. The gold, in this instance also, will be precipitated in the form of powder, and may then be smelted in the usual manner. If the shape of the article allows of it, the gold may be scraped off. The copper of the scrapings may be eaten out with nitric acid, after which the gold can be smelted. The above methods can be used for gilded coins, or the following will be found satisfactory. Mix together, in an earthenware, porcelain, or enamelled iron cup, 4 parts hydrochloric acid (spirit of salts), 1 part nitric acid (aquafortis), and 1 part water. Make warm, and place the vessel on a hob in a fireplace with a good draught to carry off the fumes. Dip the coins one by one in the mixture until all the gold has been dissolved; then rinse

well in clean water and rub in sawdust or bran until dry.

Testing Gold with the Touchstone.—Testing gold by the touch method is only a rough-and-ready test. It is by comparing the way in which nitric acid acts on certain known qualities of gold with the way it acts on the article to be tested, that the quality of the latter is ascertained. The necessary appliances are: (*a*) A touchstone (usually a piece of Lydian stone, which is a black variety of jasper): this has its surface smooth and partly polished, but is not bright; or a piece of Wedgwood black ware does very well. (*b*) A series of "needles," or pieces of gold, to be used as standards of comparison; for general use small pieces of gold wire of 9, 12, 15, and 18 carat should be sufficient. (*c*) Nitric acid kept in a special bottle having a long-pointed stopper, by means of which a small drop of the acid can be removed from the bottle without dropping any, or without any coming in contact with the fingers, for it destroys the skin where it touches. The ordinary commercial nitric acid, as sold at oilshops, will do. Aquafortis is another name for the same liquid. In testing gold, first get a rubbing on to the touchstone from one or two places which fairly represent the whole article. If possible, get on the touchstone a clean streak of gold, ½ in. long and ⅛ in. wide, and by the side of this take rubbings from the standard pieces, then put a narrow streak of nitric acid across the whole lot. Now note which of the standards is acted on in the same way as is the rubbing from the article. The effects may vary from no change at all with good qualities to complete destruction of the rubbing in low qualities. On removing the surplus acid by means of tissue-paper or a rag, the effect can be better judged. A piece of work may be very thickly plated, or even gilt, in which case the rubbing taken must go through the gold into the metal; and, on the other side, if the soldering seam alone be tested, the gold will show poorly. Therefore judgment is necessary in selecting the place where the test is to be applied; and even then it is better to file away a portion of the surface as well, and apply the stone or acid direct to it. After some practice, when one knows the effect that acid has on the different qualities, it is customary to do without the touchstone in most cases; but it is well to use it—at any rate, until one is quite used to the process roughly indicated above. Colour-gold articles do not always need the application of acid; for if, by scraping the surface, there is found to be a granular brown layer, then the quality of the article can be judged very nearly by the extent of the change that has taken place below and on the surface while the article was undergoing the process of colouring. In colouring, the gold alloy is dipped in an acid pickle which dissolves out the base metal on the surface, leaving what is, in fact, a case of pure or fine gold enclosing the alloy. If the article is coloured, it must be more than 12 carats, fine, and is generally 15 carat. Following up the manner in which gold alloys are tested as above, comparison should be made in the same way with the effects of nitric acid on silver, brass, copper, etc.; for although brass will boil green, so also will some very common qualities of silver and gold. The capability of judging qualities, after all, is largely a matter of experience. To people used to handling gold the very appearance of the article is often sufficient to denote its quality.

Testing Gold Leaf.—Gold leaf may be tested by putting a few drops of nitric acid upon glass and placing therein a small piece of the leaf, which, if pure, will not be in any way affected. Any metals with which the leaf may be adulterated will be dissolved by the acid.

Gold Paint

"Gold paint" is a mixture of bronze powders with certain solutions and varnishes. Other bronzes than "gold" are in use. Gold bronzes are made from copper-zinc (brass) and copper-tin (bronze) alloys by beating out into sheets and powdering. Silver bronzes are made from silver, aluminium, and tin in a somewhat similar manner. Many mediums have been used for fixing these bronzes—gold-size, copal

varnish, dammar varnish, and celluloid varnish. The modern method is to use transparent celluloid varnish, which is prepared by dissolving transparent celluloid waste or cuttings in acetone, afterwards thinning the preparation down with amyl-acetate. The gold-paint, when mixed, may be used for a variety of purposes both on interior and exterior decoration. It adheres firmly to metals, wood, paper, and glass, and is not friable. It may be washed repeatedly without alteration, and will resist atmospheric influences for a considerable time without losing its brilliancy. Its durability may be somewhat increased by applying two coats of colourless varnish over the work when completed. It will resist any ordinary heat, but will blister under excessive heat. Gold bronze medium used in the United States is "banana solution" (the name being derived from its odour), which is usually a mixture of equal parts of amyl-acetate, acetone, and benzine, with just enough pyroxyline dissolved in it to give it sufficient body. Powdered bronze is put into a bottle containing this mixture, and the paint so formed applied with a brush to the article to be bronzed. The thin covering of pyroxyline that is left after the evaporation of the liquid protects the bronze from the air and keeps it from being rubbed off. All the various coloured bronze powders can be used in the "banana solution." Several stiff, very small painters' brushes are needed for such work, and they must be either kept in the solution when not in use or, better still, washed in benzine or acetone immediately after use, and put away for future service. The "banana solution" is volatile, and must be kept well corked.

Using Gold Paint.—It is usual to apply two coats of ordinary lead paint, brushed out well. If for gold, the colour of the paint should be a light buff; for copper bronze it should be of a darker shade. The bronze may be applied as soon as the paint is thoroughly dry. Mix a little gold paint and use at once, taking the inner part of the work first and covering a small portion at a time. Use the brush one way only, not up and down, or shady streaks will result. Be careful to cover every part of the work, as touching up afterwards spoils the appearance.

Golf Balls

Paint for Golf Balls.—The paint such as is used for ships' bottoms might suit; or take 2 oz. each of resin and seedlac, and dissolve in a pint of rectified spirit of wine with heat. Mix the pigment to a stiff paste with good boiled oil, and add it to the above mixture; when it is dissolved, strain it. Warm the balls when applying it, and give two or three coats. Another method is by using an elastic oil made as follows: Take 10 gal. of benzine, 5 gal. of raw linseed oil, 2 lb. of resin, and 1 lb. of caoutchouc. Cut the caoutchouc into small pieces, and melt it with the resin in 1 gal. of the oil till it is all dissolved; then add the rest of the oil and the benzine. Mix the pigment with this. The last coat may be made up with varnish thinned with boiled oil.

Removing Paint from Old Golf Balls.—The paint can be readily removed by dipping the balls for a few minutes in warm caustic soda solution—1 part of soda to 10 parts of water—and scrubbing. If unable to obtain caustic soda, 2 parts of dry carbonate of soda and 1 part of quicklime may be employed; dissolve each separately in 10 parts of water and mix. After the paint has been removed the balls must be thoroughly washed.

Golf Clubs

Joining Golf Club Shafts to Heads.—This is an operation requiring much skill, as there must be a perfect fit to stand the stress at the joint. Dogwood and persimmon mostly are used for the wooden head, and these come to the headmaker in blanks from the saw. A special machine cuts them down to a rough semblance of the head, but the remainder of the work must be done by hand tools, such as the chisel, file, and glasspaper. The shaft and head are spliced one to another by means of a strong cord, and about the joint is wound a fine waterproof cord, each strand fitting so closely and evenly that it seems part of the wood itself when the whipping is completed. The so-called iron clubs are

composed almost entirely of steel, a mild grade of this material being best suited for the purpose. First quality heads are made entirely by hand, with hammer and anvil, and the cleek makers become so expert that they can duplicate almost any model of head, not only in size, but almost precisely in shape. Most of the metal heads, however, are drop forgings, and to this process is largely due the greatly reduced cost of golf clubs. All the heads, however, are finished on rapidly revolving polishing spindles, which remove all rough spots and produce the lustre of silver.

Putting Grip or Handle on Golf Club.—This is an operation done so rapidly that a skilled workman takes only a little more than a minute over it. For the best clubs horsehide is used entirely, but sheepskin, a fair substitute, is used on the other grades. The hide is cut into strips of the proper length and width by machinery, but the workman wraps the grip around by hand with a few dexterous motions, fastening the loose end with small brads or glue. Sometimes the entire shaft is covered with the finishing coat of varnish; but first the wood is saturated with shellac, which enters the fibre and plays an important part in protecting it from the weather. Over this is placed the varnish, and, after a vigorous rubbing, the club is ready for the player.

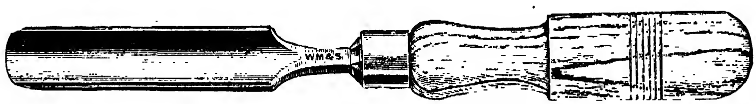


Fig. 385.—Cast Steel Firmer Gouge.

Gouges

Gouges are tools used for cutting channels or grooves in wood. Their action is that of a chisel, but their sections form arcs of circles. Fig. 385 shows a cast steel firmer gouge.

Graph (*see* Hektograph)

Graphite

Graphite, blacklead, and plumbago are practically synonymous terms for a form of carbon midway between charcoal and the diamond. Blacklead is probably the original name, and perhaps arose from the fact that the material gave a black mark as compared with a mark made by metallic lead. In practice each term has peculiar applications; thus "plumbago" comes from Ceylon, "blacklead" from Germany, Austria, and Italy, and "graphite" is exported from the United States. There are lead pencils, plumbago crucibles, and graphite lubricants, blacklead stove polishes, plumbago foundry facings, and graphite paint. There are two kinds of the material—amorphous and crystalline; the former does not occur pure, but is associated with earthy materials whose character influences the use to which it can be put. Crystalline graphite also shows great variations because of the distortion of the crystals during the process of formation. It occurs both massive and with its particles disseminated through rock; for instance, Ceylon graphite is in large masses of crystals, whilst the American kind is usually found as a small laminated flake disseminated through granitic rocks. Ninety per cent. of crystalline graphite comes from Ceylon, and the same percentage of the amorphous kind comes from Germany and Austria. The remainder of both of the kinds comes from Canada, New York, and Mexico. Graphite can be prepared in the laboratory by the following methods: (1) Charcoal is heated with molten iron, the latter being then dissolved out with hydrochloric and nitric acids. (2) Hydrocyanic acid is slowly decomposed and the product is boiled with nitric acid. (3) The mother liquors obtained in making soda are evaporated, and the cyanogen compounds contained in them are decomposed, forming ammonia and graphite. (4) Carbon monoxide is led over ferric oxide at a high temperature. (5) Carbon disulphide is decomposed in

contact with iron at a high temperature. (6) Carbon tetrachloride is led over molten lead.

Graphite and Oil Lubricant.—Graphite mixed with oil is an ideal lubricant for many purposes, if only the graphite can be kept in suspension. W. F. Downs, of Jersey City, U.S.A., has applied with much success an entirely new principle to the mixing of these two substances. Two oils are used which are not miscible with each other; that is, they act toward one another as do oil and water. The graphite is thoroughly mixed with a small quantity of oil, and the mixture is ground until each particle of graphite is coated with the oil, but there is little or no surplus. The second oil is then added, and the grinding is repeated until the graphite is thoroughly distributed through the mass. The effect is to make the graphite remain in practically perfect suspension. The explanation of the action is obscure, but it probably has some relation to that by which fog remains suspended in the air. The mixture has been found to feed successfully and without clogging in sight-feed lubricators, and gives hopes of proving a good cylinder lubricant. Very little has been added to the choice of lubricants for many years, but the effect of the use of graphite between rubbing surfaces is generally known. It coats metal surfaces with a smooth, protecting veneer, which has a very low coefficient of friction. The fact that it does this within a very wide range of temperature makes it especially adapted to cylinder lubrication, for which its merits are well recognised, although it is but little used because of the trouble in feeding it. In its dry form it can be fed intermittently only by hand, while when mixed with oil in the ordinary way it soon settles, the results of the two methods being about equally unsatisfactory; and its use has hence been confined to emergencies or to special purposes.

Purifying Graphite.—Graphite is purified by grinding or otherwise reducing it to a state of fine subdivision, washing out the heavier impurities, mixing 14 parts with 1 part of potassium chlorate and 2 parts of concentrated sulphuric acid, heating for a few hours on a water-bath, washing thoroughly, and afterwards roasting at a red heat. It also requires to be treated with hydrofluoric acid if silica is present.

Graphophones

The gramophone, says the "Bazaar," was invented by a Mr. H. Berliner, of Washington, to illustrate the practical use of Professor Bell's discovery that the vibrations caused by any series of sounds could be "written" by a vibrating point on a suitable material, and the same series of sounds reproduced by another point travelling over the inscription so made. It was one step in a long series of investigations resulting from a consideration of the properties of the telephone, invented by Professor Bell, and this gramophone—so called from *gramma*, a letter, and *phone*, sound—consisted of a flat disc revolving horizontally and bearing on its surface the inscription impressed by the vibrating point. It had previously been discovered that a cylinder revolving on a spindle could take on the inscriptions, and that from these inscriptions the sounds could be reproduced by causing another point to travel along the engraved cylinder while the latter revolved on its spindle under the point. This primitive form of machine—the notion of Bell and Edison—was called a phonograph, from *phone*, sound, and *grapho*, I write. But all the machines distinguished in England as graphophones, phonographs, and gramophones are called graphophones in the United States Patent Office, whatever other names makers may give them. The difference is not in the principle involved in the reproductions, but in the mechanism employed. The Columbia Phonograph Company states that every talking machine now makes its records by engraving sound waves in a wax composition. This was first made known to the world by the inventors of the graphophone. The phonograph was a machine that indented its records on metal foil. The gramophone etched its records in an acid bath. But the true phonograph or the true gramophone no longer exists, except as a curiosity. Every successful talking machine to-day em-

ploys the graphophone process of engraving its records, and is, therefore, strictly speaking, a graphophone.

Grasses

Bleaching Grasses and Ferns.—Dissolve 1 oz. of chloride of lime in 10 oz. of water; also 1½ oz. of washing soda in 10 oz. of water; mix and filter. Keep the solution in a stoppered bottle. Place 8 oz. of water and 1 oz. of the above solution in an earthenware dish, allow the plants to remain therein for a few minutes, then transfer to another dish containing dilute hydrochloric acid (1 part of strong acid to 20 parts of water). As soon as the plants are bleached, place them in a bowl and allow cold water to flow over them for at least an hour; remove, and place on sheets of clean blotting-paper. Move them into their proper position with a wet camel-hair brush and allow to dry. The plants should be bleached in their green state, if possible. Tender plants will bleach in a few minutes in the hypochlorite solution alone, and will not need the acid, whereas tough plants will require some time.

Dyeing Fancy Grasses.—Allow the grasses to soak for some time in a very hot and strong solution of aniline dye in water. Those dyes which are not soluble in water may be dissolved in spirit, and the solution added to water. Some aniline dyes will colour direct in this way, but others require a mordanting or fixing agent. For fixing basic dyes, such as magenta, methyl violet, etc., the grasses should first be soaked in a hot solution of oak bark or of sumach. Many pretty shades may be obtained by first soaking in a hot solution of picric acid, and then in magenta, methyl violet, methylene blue, etc. For green, picric acid and indigo extract may be used. In all cases the dye solution should be strong and hot, or the dye will not penetrate. The grasses should be quickly dried after soaking in the colours.

Pampas Grass (*see* main heading "Pampas Grass").

Gravestone

Cleaning Old Gravestone.—If the stone is in good condition, but dirty, rub the surface with fine sharp sand and water, or with a soft gritstone. If the dirt is caused by the vegetation in consequence of the stone lying flat, scrape the stone as clean as possible, then scrub it well with a solution of washing soda and water, and rinse off with clean water, the soda solution being applied with a stiff brush. If this does not clean it, apply a solution of hydrochloric acid (spirit of salt) and water, about 1 part of acid to 10 parts of water. The acid solution must be well washed off with clean water, or it will act on the surface of the stone, and may cause it to perish by the weather. It may require two or three applications of either of the solutions, or the acid solution may be made a little stronger. Great care must be taken to wash the acid solution off the stone, and to prevent it touching the hands or clothes, or it will burn them. A good preservative would be to cover the foundation under the stone with a double course of slates bedded in Portland cement, or with sheet lead laid over the whole surface. This would prevent damp arising. A composition of equal parts of turpentine and boiled oil, to which a little colour is added, is sometimes used at the base of a stone. This is made very thin, and is dabbed on the stone with a cloth, and then dry rubbed with a soft brush, but the cloth must not be applied twice in one place or it will be streaky. The stains may be caused by trees in the vicinity, in which case it may be advisable to paint the stone. This, if well done, would last a considerable time without attention. If either the composition or paint is used the stone must be perfectly dry when it is applied.

Grease (*see* Fat)

Grease Paints

By mixing the following ingredients with sufficient almond oil a white grease paint may be made: Prepared chalk, 4 oz. (avoirdupois measure); zinc oxide, 4 oz.; bismuth subnitrate, 4 oz.; asbestos powder, 4 oz.; camphor, 40 gr.; oil of peppermint, 3 dr.; and esobouquet extract, 3 dr. To make red grease paint, melt together 4 av. oz. of cacao butter and 4 oz. of white wax, add 2 oz. of olive oil, stir in 90 gr.

of carmine previously dissolved in 3 dr. of ammonia water, add 8 drops of otto of roses, 3 drops of oil of bergamot, 2 drops of neroli oil, and 2 drops of tincture of musk. Form into sticks. For black grease paint, the colour used is soot obtained by burning camphor and repeatedly washed with alcohol. Triturate 2 av. oz. of this soot with 2 oz. of sweet almond oil to a smooth mixture, add it to 6 av. oz. of melted cacao butter, add suitable perfume, and form into sticks. Brown or other coloured paint may be made by substituting for the black soot other pigments such as burnt umber, sienna, ochre, rouge, etc.

Greaseproofing

To greaseproof paper to be used for packing, give it a coat of thin size to which about 1 or 2 per cent. of potassium bichromate has been added. During drying the paper should be exposed to the light, which will render the glue insoluble, when the paper will not only be greaseproof but also practically waterproof.

Gum

Colourless Gum.—Gum arabic is the palest gum that is soluble in water. Buy a good quality of gum, and pick out the white pieces. If the solution when made is not absolutely white, warm it with a little powdered animal charcoal, stirring well all the time, then filter through a flannel bag until it is clear and bright. It is difficult to get rid of every trace of colour, but the faint yellow tint may be corrected by adding a trace of dry washing blue to the chalk with which the gum is used; it appears pale blue when wet, but dries snow-white. White dextrine is a colourless gum. It is quite soluble in water, and if boiled, say, about $1\frac{1}{2}$ lb. to 1 qt. of water, forms a thick transparent gum. White dextrine may be got at any wholesale druggist's, or from gum manufacturers.

Dextrine.—Dextrine (sometimes called British gum) is a substance formed from potato starch by heating alone, or after sprinkling with nitric acid, to a temperature of 300° F. to 400° F. It has the same composition as starch, $C_6H_{10}O_5$, but it differs materially from that substance in its properties. It is very soluble, even in cold water, and forms a viscous and gummy solution. There are two varieties of dextrine—the white and the brown; the white dextrines contain soluble starch, and the brown dextrines contain some glucose. To prepare gum for gummed labels, dissolve 1 part of dextrine in 3 or 4 parts of water; this will form a solution that will not sink too much into the paper and will yield a layer of gum on the surface when it dries. Another method is to mix equal weights of dextrine and water, and stir from time to time until dissolved. As a preservative, add a few drops of carbolic acid. Either hot or cold water may be employed, but the operation is more quickly performed if hot water is used. The cheaper dextrines are sometimes adulterated.

Dextrine, Clarifying.—A solution of dextrine may be rendered clear, but it is doubtful whether it could be made quite colourless like water. Add for each pint of dextrine solution $\frac{1}{2}$ drachm of alum dissolved in $\frac{3}{4}$ oz. of water; shake thoroughly, and then add $\frac{1}{4}$ drachm of washing soda dissolved in $\frac{1}{2}$ oz. of water; again shake, and allow to stand for a few days. The hydrate of alumina precipitated out will carry with it the suspended matter and some of the colour, leaving the liquid much clearer and brighter.

Gum for Envelopes and Postage Stamps.—Dextrine is at present used in Great Britain for postage stamps and envelopes. Originally, however, gum arabic was employed; this gives a thicker coating and is not so soluble as dextrine, and therefore requires to be moistened more thoroughly before it will adhere.

Ironfounders' Core Gum.—In some gums dextrine forms one of the chief agents for binding; in others, sugar refiners' refuse; while a few gums have powdered glue as the binding material. The following mixture is largely used: Common coarse brown flour refuse 40 lb., gypsum in powder 16 lb., salt 8 lb., and powdered common dextrine 1 lb. Core gum, ready prepared, can be obtained at 15s. per cwt., and only a small quantity is used at a time (say 2 lb. per cwt. of core sand, according to the class of work being done).

Liquid Gum for General Use.—Liquid gum may be made from either gum arabic or dextrine. Gum arabic is more expensive than dextrine, the former costing from 1s. to 3s. 6d. per pound, while the latter only costs about 6d. per pound. Gum arabic, however, goes much farther than dextrine, produces a more viscous solution, a thicker coat on the paper, and holds very tenaciously. Dextrine produces a thin solution and a thin coat which does not hold so well, but it is quite suitable for thin paper, and for this purpose it has been very largely used during the last twenty years. To prepare a liquid gum from gum arabic, take $2\frac{1}{2}$ lb. of the gum, say at 1s. per pound, add 2 pt. of water, and stir thoroughly with a stick from time to time until all the gum has dissolved; if the solution is too thick, add a little water, but be careful not to thin it too much; then strain through muslin, add a few drops of carbolic acid, and bottle. A liquid gum may be made similarly from dextrine, using equal parts of gum and water; this will dissolve in a much shorter time than gum arabic.

Preserving Gum.—A drop or two of carbolic acid or oil of cloves will prevent gum going mouldy without otherwise affecting it. An office gum preservative of German recommendation is camphor; a small piece of this put into the liquid gum gives off vapours which kill all bacterial germs that enter the gum bottle, and which are the cause of gum deteriorating in strength.

Quick-setting Office Gum.—To prepare gum arabic to give the best results it should be stewed, says one who has experimented in this matter. Place the crystals in a shallow saucepan with enough water to a little more than cover them, and expose to a gentle heat until the gum is softened without being burnt. Then add more, either warm or cold, water until the desired thinness is obtained, transferring to a suitable vessel. If cold water is used some stirring will be required. Gum prepared in this way will be found to be very adhesive, and if applied to labels, etc., will stand redamping when the labels are wanted. Gum bottles should be well corked; a little vaseline will prevent the corks sticking.

Gum Thus (*see* Turpentine, Venice)

Gumming

Gumming Labels to Glass and Iron.—A gum for this purpose may be made by agitating gum tragacanth in water until dissolved, and then adding a solution of gum arabic, afterwards filtering. Add a quantity of glycerine equal to that of the gum arabic solution; the glycerine should contain just a trace of oil of thyme or cloves. If necessary, dilute with water, and the gum is ready for use.

Gumming Paper to Glass.—Strongly adhesive gum, fit for sticking paper and glass together, can be made by adding 2 or 3 parts of aluminium sulphate dissolved in 20 parts of water to 230 parts of gum arabic solution.

Gun

Blueing Gun Barrels.—Before the process of blueing is begun, the ironwork of the gun should be polished on emery bobs of different degrees of fineness in order to remove all file marks. The flat parts are stick-polished, and then burnished with a hard stick burnisher. In large gun factories dead-level polishing is effected by lapping on a revolving leaden surface plate with emery and water; the bobs and laps are driven by steam power at about 2,500 revolutions a minute. In small gunshops the bobs are run on a foot lathe. The ironwork intended for blueing must also be burnished after it has been polished. The burnishing closes the grain of the iron, and the work has a high gloss and a deep colour when finished. The polishing bob is of wood from 10 in. to 15 in. in diameter, around which a layer of buff leather is glued; the surface of the leather is coated with emery powder by means of glue; the emery coating must be constantly renewed. Several bobs, of different degrees of fineness, must be kept ready at hand to be changed as required. When the work is polished it is engraved if desired, and then case-hardened or blued. This is done by placing it in a pot in which sufficient animal charcoal has been put, so that all the work may be well covered. The pot is then set on a bright but slow coal fire until the whole is of a dull

red colour, and the work is left in it from an hour to an hour and a half. After some practice an operator can tell when the work is ready to be taken out. It is then plunged into cold water, which makes the surface quite hard. If bone dust, to make the animal charcoal, cannot be obtained, old shoes burnt to powder will be a good substitute. The blue colour is produced by heating the work in a pan or pot of well-powdered vegetable charcoal, taking care that the work to be blued is well covered with the charcoal. The work will change colour repeatedly during the process, from a light straw colour to a dark blue —which latter shade it receives in from twenty to thirty seconds, according to the size of the article. The barrels of guns and rifles in which cordite has been used should be cleaned with a wire gauze pull-through, and then with sweet oil. This will remove any foulness. Guns not in use should be kept in a dry place.

"Bore" of Shotgun.—The "bore" of a shotgun is thus explained by the "Scientific American." Anyone who is familiar with modern rifles and heavy ordnance might think that the word "bore" here was used as a unit of length, as when it is said that 50-calibre 6-in. rifling is 25 ft. long, or fifty times the calibre (diameter of the bore) in length. But, as a matter of fact, the term "10-bore," "12-bore," etc., when applied to shotguns, does not indicate length, but always refers to the diameter of the bore. In the days of our forefathers, when rifle balls were spherical, and long, cylindrical, conical-headed bullets and rifled barrels were undreamed of, the gunsmith adopted a curious but convenient method of designating the gauge or diameter of the bore. He expressed it by stating how many bullets, of a size that would fit a particular musket, would go to make a pound. Thus, a 10-bore musket would be one of such a bore that ten of its bullets would go to make a pound weight; a 16-bore gun would be one whose bullets would run sixteen to the pound, and so on. Hence the anomaly that the larger denomination musket has the smaller bore. Although the day of the spherical bullet has long passed away, and the only smooth bore remaining is the shotgun, the old method of designation has been retained.

Browning Figured or Twist Gun-barrels.—Browning gun-barrels is a somewhat dirty and by no means pleasant process; it is simple enough, although requiring great care. On no account must anything of a greasy nature come in contact with the barrels during the work; even one's hands should be carefully washed. A small piece of Turkey sponge quite free from grit, some clean rag, and a small quantity of whiting are required; also, if possible, a scratch-brush, though if this cannot be obtained a piece of scratch-card can be used instead. The browning mixture is as follows: 1 oz. of muriatic tincture of steel, 1 oz. of spirit of wine, ¼ oz. of muriate of mercury, ¼ oz. of nitric acid, ¼ oz. of blue vitriol, and 1 qt. of soft water. A quarter of the above quantities is quite sufficient to mix up at once, and if kept well corked will last for a considerable time. In mixing the ingredients, the nitric acid should be put in the bottle first, and half the required quantity of water added; the other ingredients can then follow, the balance of the water being put in last, and as soon as the mixture is dissolved it is ready for use. To prepare the barrels for browning they must be made bright with emery cloth, F being about the best to start with, finishing with 0. If the rust is eaten in they will require to be smoothed, and possibly "struck up," as it is termed in the gun trade. But this is a matter outside the scope of the present article. To clean the top and bottom ribs, shape a flat piece of cork to fit them, cover it with a piece of emery cloth, and move it briskly up and down in a straight line, taking care not to run over the edges of the ribs. As soon as the barrels are polished they must be wiped down with a cloth, after which they should be plugged alternately at the muzzle and the breech with clean corks. The other sides should have wood plugs 10 in. long, 4 in. of which should enter the barrels, the outer part being used to hold the barrels by when coating and scratching them. A small quantity of whiting must now be mixed with water to the consistency of cream and rubbed all over the barrels and left till it dries, when

it can be either brushed off or rubbed off with a clean rag. The object of the whiting is to remove all grease from the barrels. These must now be coated lightly with the browning mixture, a piece of sponge being dipped into this and squeezed between the thumb and fingers before being applied, so as not to give too heavy a coat. The sponge is drawn up and down the barrels, care being taken that they are not coated twice over. After coating, the barrels are left about five hours, and then scratched with the scratch-brush or card, care being taken to remove all rust; after this they must be rubbed down with the clean rag, and recoated as at first with the sponge. They can now be left six or seven hours, when the same process must be gone through, this being afterwards repeated daily for four days, when, after rubbing with the rag, a kettleful of boiling water must be poured all over the barrels. Then rub them well down with the clean rag, and when about half cold scratch them very lightly to polish them, and then oil them with neat's-foot oil outside and in, after removing corks and wooden plugs. The twist in the barrels should begin to show very plainly on the second day. Old linen rag, well washed in soda water to remove all grease, is the best to use, and rain or soft water is preferable for scalding the barrels with.

Browning Military Rifle Barrels.—In preparing steel or plain iron barrels for browning, whether for military or sporting purposes, the same plan is adopted for making them bright as given for twist barrels above. The first thing now to do is to boil the barrels in a strong solution of soda and water, about $1\frac{1}{2}$ lb. of soda to the gallon, for twenty minutes; this is done to remove the grease. After taking the barrels out of the soda water, wash them in clean warm water, and wipe them with a clean rag. When cold, coat them with the following mixture, rubbing it well in: $\frac{1}{2}$ oz. of nitric acid, 2 oz. of spirit of wine, 3 oz. of spirit of nitre, $3\frac{1}{2}$ oz. of tincture of steel, $\frac{1}{2}$ oz. of blue vitriol, $\frac{1}{2}$ oz. of corrosive sublimate, and 12 oz. of spring water. The quantities given are sufficient for browning sixty barrels, if used carefully. The barrels must now be left to stand all night. Usually, in a gunmaker's shop, a drying room is fitted up for this purpose, with a small box stove in the centre, as the room requires to be heated to about 80° F. to dry the barrels properly, so that they may receive two coats each day. At the same time, an old case lined with tin, placed near the fire in a warm room, can be made to answer the purpose when two or three barrels only are required to be browned. On the second day scratch the barrels off with scratch-card if dry. It can easily be ascertained whether the barrels are dry or not; if dry, the rust will fly off quickly when the scratch-card is applied; but if not dry, the rust will adhere firmly, and the barrels will present a streaky appearance. As soon as they are scratched off the barrels must be recoated, and left till late in the afternoon or evening. They must now be boiled in clean soft water for twenty minutes, and, after taking out of the boiling water, must be left till cold, then recoated lightly and allowed to stand till morning. On the third day the same process must be repeated. So, too, on the fourth day, except that, after boiling and scratching, the barrels must be immersed in hot water, and, when nearly cold, oiled inside and out with neat's-foot oil. The barrels should always be cold before boiling; the same water can be used for boiling all through the process, being replenished as evaporation takes place. A boiler can easily be made with a few sheets of tin-plate. The wooden plugs for holding the barrels can always be removed when scalding them, the water being allowed to flow through them; and it must be perfectly understood that nothing of a greasy nature must come in contact with the barrels while they are being browned. Turkey sponge should be used when coating the barrels.

Cleaning Guns and Rifles.—The "Bazaar" says that it is most important that the weapon be properly cleaned as soon after its day's work is done as possible. Although more expensive, a wood-covered steel rod is far better than a common brass rod or pull-through. Jointed hardwood rods are made for shotguns, and are very handy. There are several ways of cleaning the barrels.

Some prefer a slip of flannel threaded through a loop in the cleaning rod. Others recommend washing out small-bore rifle barrels with boiling water and a bristle brush. If the water is hot enough to leave the barrel dry when the operation is over, it may answer very well; but it is not a pleasant process, especially if the barrel is foul with the residue of black powder. Another method is to use cotton-wool or tow wound round the jag of the cleaning rod; and a small piece of cotton-wool, pushed through from the breach end, is a good way of beginning. Care should be taken that it is not large enough to get jammed. After the interior of the barrel is bright and clean, it can be tested by a piece of white cotton-wool wound round the jag not becoming soiled when pushed through—the cotton should be well smeared with vaseline and pushed and pulled through several times. Too much wool should not be wound on, or it will not leave enough vaseline behind it to protect the barrel from rust. If an expensive small-bore rifle were to be put away for any length of time, it would be economy to fill the barrel with vaseline, and so effectually prevent the rifling from becoming damaged by rust.

Greasing Gun Felt Wads.—A mixture of equal parts of tallow and beeswax is made by heating the ingredients till they are thoroughly incorporated. The wads are then dipped in the mixture when cool and rubbed with non-absorbent cloth. Some makers well grease some sheets of good hard tough felt, and punch out the wads by cutters fixed in a press.

Gun-barrel Preservers.—A rod wrapped in flannel and soaked in oil may be placed in each barrel when a gun is not in use. The rod is known as a barrel preserver, and is very good if made to fit the inside of the barrel. It must be well saturated with either olive or neat's-foot oil, and requires removing and re-oiling about every four months. It will not cause the barrels to become honeycombed. After use, wash the barrels out with warm water, and oil them while still warm.

Renovating Interior of Rifle Barrel.—Below is explained how to clean the interior of a saloon rifle which has become coated with lead. Bend a length of stout iron wire to form a slot, in which a piece of rag may be wound tightly. Dip this into oil, and then into flour emery, and work it up and down the barrel till the lead is removed. If this fails, get ¼ lb. of fine steel needle wire, and wrap it round two 3-in. wire nails driven, 3 in. apart, into a board. When enough has been wrapped so that, bunched up together, it will go into the barrel easily, bind it round with fine copper wire, leaving a loop at each end about ½ in. long. Cut through the end of one of the loops with a pair of nippers, and bend outwards all the free ends, like a sweep's brush; then attach the other loop to a length of strong wire and pull the steel brush repeatedly through the barrel until the lead is removed. To clean a rifle after ordinary practice, send down a piece of clean rag, followed by an oil rag; if this is insufficient, use hot water and soda. Neat's-foot oil, free from water and impurities, is the best for guns.

Guttapercha

Guttapercha is the coagulated juice of an evergreen tree growing in many places in the tropics, but principally in the jungles of the Malay peninsula and archipelago. It is softened with heat, and is practically inelastic. It is soluble in ether, chloroform, benzol, bisulphide of carbon, and turpentine. Its chief use is as an insulation, as a substitute for leather, and as an ingredient of a great number of useful cements. Raw guttapercha enters commerce in an adulterated form, foreign matters having been added by native labourers for the purpose of making it weigh heavier. There are two methods of treating raw guttapercha for removal of the impurities. The gutta may be softened in water at a temperature of about 50° C., and is then rolled out into a band by iron rollers, the top roller being loose, so that any stones or hard bodies raise it and pass through. The stones, etc., are then picked out and the gutta strips folded into loose blocks, which are treated in a cylinder, and on emerging are cut into shavings by two revolving wheels. Or the gutta is placed in boiling water and then brought between two cylinders; the inner one revolves and, being covered with sharp teeth, tears

the gutta to shreds, which are carried away by water flowing between the cylinders. The shreds are softened in hot water, and the mass is kneaded in a machine in which are two or more revolving rollers covered with blunt spikes. The materials used to harden and colour guttapercha are orange or red lead, chrome, vermilion, yellow ochre, sulphur, caoutchouc, gypsum, and resin. Guttapercha, when pure, just floats in water, with nearly all its volume under the surface; its specific gravity is ·96285 or ·99923, according to two differing authorities. Guttapercha can be made into a horny substance by cutting it into shreds, dissolving these in carbon bisulphide, and then adding and stirring in a tenth as much, by volume, of chloride of sulphur. Thus treated, boiling water will not soften it again. Exposure to the fumes of chloride of sulphur or immersion in a bath of carbon bisulphide containing one tenth its volume of chloride of sulphur will also cure guttapercha. The dipping must be done by stages, the length of the time it remains immersed being increased gradually, or it will dissolve instead of hardening.

Bleaching Guttapercha.—To bleach guttapercha, dissolve it in twenty times its weight of boiling benzine, and add plaster of the best quality to the solution, shaking from time to time. In a few days' time the plaster will have settled to the bottom, carrying with it the impurities soluble in the benzine. Decant the liquid and introduce it in small portions into a vessel containing double its volume of 90 per cent. alcohol, stirring continually. During this operation the guttapercha precipitates in the form of a perfectly white paste-like mass. The drying of the guttapercha thus purified requires several weeks' exposure to the air; this may be accelerated by triturating it in a mortar, and removing from it the water that separates.

Difference between Guttapercha and Rubber.—These two substances are constantly confused. A standard work on the subject shows the difference by means of the following comparison in double columns:

INDIARUBBER. (Gum elastic.)	GUTTAPERCHA. (Gum plastic.)
Raw rubber is soft and malleable when heated, but is still elastic within a certain range of temperature.	In boiling water, becomes plastic and malleable, and if then shaped, preserves its form when cold.
Acted on by air, becomes viscous.	Acted on by air, becomes brittle and resinous, but not so quickly as rubber.
Chief applications are in the sulphur-vulcanised condition.	Will not combine or intimately mix with sulphur.

Guttapercha Cement.—This is used for a multitude of purposes. When required for patching leather boots, dissolve in 5 parts (by weight) of carbon bisulphide and 10 parts of oil of turpentine, 2 parts of finely shredded pure guttapercha and 2 parts of finely powdered Syrian asphalt. When cold, the mixture should be of the consistency of honey, and it may be necessary to boil it to attain this consistency. In using the cement, previously remove all oil from the parts to be joined by applying benzine. Ordinary guttapercha solution or cement is made by dissolving guttapercha in bisulphide of carbon. The vessel should be frequently shaken. The solution may be bleached, if desired, by filtering through animal charcoal.

Guttapercha Soles (*see* Boots).

Gypsum (*see* **Plaster-of-Paris**)

H

Hammers

THE variety of hammers in use in the arts and crafts is very large, but this does not much concern the handyman, who can get on very well with one or two woodworker's hammers, although the addition of an engineer's hammer would frequently be found of advantage. Three good hammers are the Exeter or London pattern (Fig. 386), the Warrington (Fig. 387), and the adze-eye claw hammer (Fig. 388), the last named being a very useful tool in the home. Hammer heads are of iron with steel faces (penes). A light hammer for general use is a mistake; more blows are required, and it tends to disfigure the work. Engineers' hand hammers are of three principal kinds, the difference between them consisting chiefly in the shape of one pene. There are the ball pene (Fig. 389), the cross pene (Fig. 390), and the straight pene (Fig. 391). Sledge hammers hardly interest the handyman, but it may be said that about three types are in common use—the double-faced hammer (Fig. 392), and the cross pene and straight pene hammers, corresponding to Figs. 390 and 391, but having one pene as in Fig. 392.

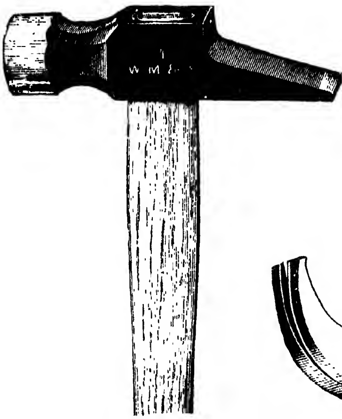


Fig. 386.—Exeter or London Hammer.

Fig. 388.—Adze-eye Claw Hammer.

Fig. 387.—Warrington Hammer

Corrugated Handles.—Corrugated handles of hammers help to keep the hand from slipping, especially when striking hard blows and nailing in awkward places. The ridges are made by turning the handles in the lathe, or they could be cut with edge tools or rasp, and smoothed with glasspaper.

Fixing Hammer Heads to Handles.—The best way of fixing a hammer head is to use one with an eye or opening shaped as shown in the sections (Figs. 393 and

394), the hammer head being secured with a single wooden wedge as shown in Fig. 395. Sometimes a loose hammer head can be

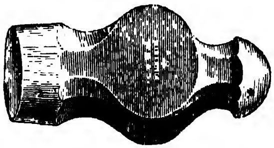


Fig. 389.—Ball Pene Hammer.

tightened by driving in a few short, stout nails beside the wedge, or by soaking all night in water. It is a good plan to fix wedges by means of two wire nails (driven into holes previously bored for their reception), as shown in Figs. 396 and 397.

Hardening Hammers (*see* Hardening and Tempering).

Soft-pened Hammers.—Soft-pened hammers for driving keys and other work should be faced with Babbit's metal or lead in preference to copper, which gets harder the more it is used. A lead hammer, which will not get out of shape, can be made with a piece of copper pipe of suitable size; drill a hole in one side of it, and fit with a handle, and then fill in the hollow of the copper pipe with lead. Even better than the lead hammer are hardwood blocks on end; in use they are put against the part to be driven, and then are struck with a hammer. Blocks about 5 in. square and 3 ft. long can be used for driving the stub ends of keyed-up connecting-rods on large engines back and forth.

Hands

Saving the hands from dirt is a great thing to many people engaged in engineering

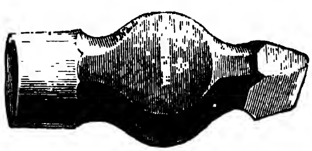


Fig. 390.—Cross Pene Hammer.

work and the like. Ordinary vaseline will be found a protection against dirt and grease; a little rubbed into the hands each morning and noon is much better than using any dirt remover. The vaseline works into the pores of the skin, forming a coating which

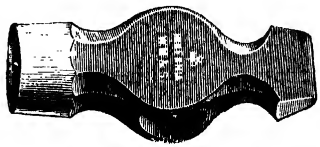


Fig. 391.—Straight Pene Hammer.

is impregnable to any dirt. This is washed off at night, using soft water and a good "ivory soap" lather. After a thick lather is obtained, dip the hands in corn-meal, bring them together, and then well rub the meal into the crevices of the hands and fingers. For the callous places on the forefinger, a cake of scouring soap, rubbed on lightly, is necessary. The above is the result of an engineer's experience as contributed to an American technical paper.

Cleaning Grimy Hands.—For cleaning grimy hands soiled by working with machinery, etc., the following method has been recommended. In the morning, wash in warm water, using a stiff brush, and apply glycerine. Again apply two or three times during the day, washing an hour or so afterwards, and using the brush. Usually in the course of forty-eight hours the hands are clean. Another plan is to apply a wash solution of liquor sodæ or potassæ, and wash in warm water, using a stiff brush, as before. Finally, wash the hands, rubbing them down with a piece of pumice or infusorial earth. There are soaps made especially for this purpose, similar to those for use on woodwork, etc., in which infusorial earth, or a

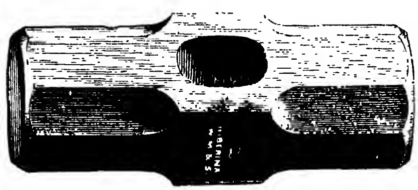


Fig. 392.—Double-faced Sledge Hammer.

similarly sharply comminuted matter, is incorporated. The following is a recipe for removing dirt from the hands, arising from

working among salts:—Dilute hydrochloric acid (spirit of salt), 1 part acid to 2 parts water; this is a good reagent, but if any

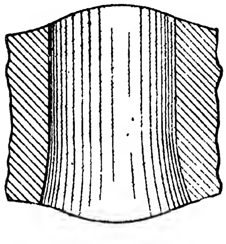


Fig. 393.

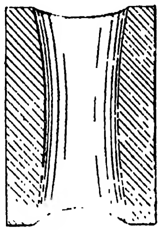


Fig. 394.

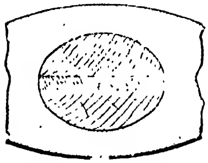


Fig. 395.

Figs. 393 to 395.—Diagrams showing Best Method of Fastening on Hammer Head.

recent cuts are touched it will make them smart.

Removing Aniline Stains from Hands.—To remove aniline stains from the hands, washing with ammonia water is often effectual. For more obstinate stains, first use a little bleaching powder and then strong alcohol. When the hands have become begrimed with the stain, apply liquor potassæ for a moment, plunge the hands into soft warm water, and rub with a stiff brush, care being taken to avoid making painful sores. Or repeatedly apply the liquid, very much diluted, to the backs of the fingers and around the nails, and thus save the scrubbing. The palms of the hands can stand stronger applications. Methylated spirit, a solution of pearlash in water, or dilute hydrochloric acid, may also be used.

Removing French-polish Stains from Hands.—For general purposes there is nothing better for cleaning the hands than a piece of soft soap, some fine sand, and plenty of warm water. To remove french polish, use a little methylated spirit; and for Bismarck brown or dye stains, use hydrochloric acid diluted with three times its volume of water; wash the latter off thoroughly before soaping, and do not let it get near bruises or cuts, or it will make them smart.

Removing Leather Stains from Hands.—Wash the hands well in soap and water, warm, and then wash again in clean warm water; half dry on a towel, and pour a little weak oxalic acid into the palm and rub it well in where the stains show most.

Removing Nitrate of Silver Stains from Hands.—A solution of iodine in ammonia water can be used, but nitrogen iodide, a powerful explosive, may be formed. A safer solution is made by dissolving 3 parts of iodide of potassium in 10 of water, adding 2 of iodine, and then sufficient water to make 100 parts. This is kept in a well-stoppered bottle, and when in use is applied to the stains, thus forming silver iodide. To remove this, a 10 per cent. solution of caustic soda is applied.

Removing Pyro Stains from Hands.—Whether anything will completely remove pyro (pyrogallic acid developer) stains, if they are very deep, is exceedingly doubtful. Keep the pyro well preserved with potassium metabisulphite, and use plenty of sodium sulphite in the developer. Light stains may be removed if treated whilst still wet with a 5 per cent. solution of hydrochloric or citric acid. This only bleaches the stain, as may be proved by plunging the fingers into soda-water, when the stain returns. The fingers should therefore be well washed in plain water after the acid. Thiocarbamide is good for removing pyro stains. A method that can be tried is to dip the hands in a strong solution of

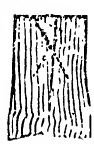


Fig. 396.

Fig. 397.

Figs. 396 and 397.—Wedges in Hammer Handle Fixed with Nails.

chlorinated lime and then rub the stains with a large crystal of citric acid. Alternate these processes until the stains are

removed, and then rinse the hands in water.

Removing Silver Stains from Hands.—To remove silver stains from the hands or clothes, use a solution of 1 part of mercuric chloride and 1 part of ammonium muriate in 8 parts of water.

Removing Tanning Stains from Hands.—There is not any way of removing tanning stains; a wash with carbonate of soda or dilute ammonia, and then with dilute sulphuric acid, may do something, but prevention is better than cure. A pair of tight rubber gloves might do for keeping the liquor out. The partial tanning that the skin of the hand is subjected to cannot be removed without destruction of the skin. Before beginning work in the morning, warm the hands, and rub them well all over with tallow; the greasiness of this should keep the liquor out. To keep the hands soft, rub them, after work, with a lotion made by shaking olive oil with lime-water; this is an excellent thing when the hands are hard and sore.

Removing Tobacco (Cigarette) Stains from Hands.—A solution of chloride of lime (bleaching powder) might be tried, but it is very doubtful whether any reagent will remove the stain. Such stains are extremely difficult to remove when on the surface only, but the smoke from cigarettes penetrates the skin and stains it yellow right through.

Removing Wire Stains from Hands.—To remove from the hands stains caused by handling wire that has been dipped in spirit of salt and lime, rub the hands with a weak solution of acetic acid or citric acid. The hands can be softened by rubbing with neat's-foot or olive oil every night. The handling of the wire leads to the hardening of the skin, and it will not be possible to get the hands very soft.

Sweaty Hands.—Sweaty hands are a great trouble to metal workers, the sweat causing brown stains on bright work. Sweating of the hands can be prevented to some extent by rubbing them with olive oil; this would prevent the action of the sweat on the bright metal parts to be handled. Another plan is to have at hand, while working, a box of fuller's-earth, French chalk, or light magnesia; in this, dip the hands when they become moist. The powders mentioned are rapid absorbents and will keep the hands quite dry.

Hardening and Tempering

Steel is hardened by raising to a certain temperature, and then quenching rapidly. The minimum temperature necessary will vary with the steel. Only very special steels can be hardened by quenching from a low red heat. A bright red heat is usually necessary with every-day tool steels. Within limits, the resulting hardness will be greater as the temperature at which the steel is quenched is higher. The quenching must be rapid, though it need not be instantaneous. Slow cooling increases softness, not hardness. The greater the speed of quenching, the greater (within limits) will be the hardness obtained from a given temperature. Sudden quenching—no matter how sudden, if only uniform—will not crack sound steel; but unequal quenching will strain it heavily, and may possibly crack it. Articles like machine moulding-cutters, therefore, are liable to crack, as their sharp re-entering angles are so many weak places. Articles in which there are sudden changes of thickness must always be heavily strained on quenching, as the thin parts (besides being liable to be the hottest) get cooled and shrink, while the neighbouring thick parts are still expanded. For delicate articles, therefore, it is desirable to reduce the rapidity of quenching to a minimum, and then the initial temperature must be increased to correspond (1,450° F. quenched in water, and 1,620° F. quenched in oil, would give nearly similar hardening results). Using an oil bath instead of a water bath, quenching in tallow, and sometimes even quenching in melted lead, are methods employed to give effect to this principle. The use of melted lead may seem curious; but what is necessary is not to carry the steel rapidly from a certain high temperature to the temperature of the atmosphere, but to carry it rapidly from a high temperature to a temperature below a critical point. The modifications of hardness that can be produced by vary-

ing temperature and speed of quenching have tended to the practice of what is known as "hardening and tempering" at one operation—which is really hardening to so mild a degree that tempering is unnecessary. This is not to be recommended except for very small articles, such as watchmakers' drills, etc., where separate hardening and tempering are almost impracticable. In ordinary practice the rule should be: First get the most perfect hardness; then temper or modify this hardness by uniform reheating to a temperature between 430° F. and 600° F., according to the purpose of the tool. If a place is brightened before the reheating, the desired temperature can be judged by the change of colour. For moulding-cutters, a dark bronze tending to blue is suitable. When the desired temperature is reached, the heating must be instantly arrested. The article can then be quickly cooled or left to get cold by itself; it will make no difference.

Case-hardening.—Generally, only iron is case-hardened, but steel, if it is mild or made by the Bessemer process, is also suitable. Any articles of good iron can be case-hardened, but the hardening penetrates only skin-deep. There is no occasion to temper the iron at all after case-hardening, and any parts of the objects can be rendered hard, leaving the other parts in their normal condition. An ordinary fire will furnish all the heat required. The hardening compound is made as follows: Take equal parts of prussiate of potash, sal-ammoniac, and common salt; pulverise, and thoroughly mix. First make the iron hot, and spread the compound over the part to be made hard; again put the iron in the fire and fuse the powder, allowing it to run all over the parts to be case-hardened. Up to this stage the metal should be heated to only a moderate extent—say, just bordering on red heat. The compound may be applied several times; the more put on, to a certain extent, the deeper will be the hardening. This is a detail which practice alone will enable one to determine. Having thoroughly melted a quantity of the powder, and allowed it to soak in at a dull-red heat, raise the temperature to that required for hardening steel (a full blood-red), and quench the article in cold water. The surface which has been operated on by the hardening powder will now be as hard as hardened steel, whilst that part which has not had any powder applied to it will be as soft as before. This is the most simple process, and will be found very easy to perform. Prussiate of potash by itself will effect the hardening, but the compound mentioned above is better. Practice will enable one to judge the exact quantity of powder required to produce the desired effect.

Case-hardening Large Wrought-iron Work.—Large wrought-iron forgings of perhaps irregular shape require to be treated in a manner different from the above. They are box-hardened in the following manner:—For the heaviest work, cast-iron boxes of circular form with cast-iron covers are used. They are of sizes suitable for the work in hand, ranging between 1 ft. and 2 ft. 6 in. in diameter. For small work, tubes of wrought iron or old pulley bosses are used. The bottom of the box is covered with a thick layer of the hardening material, which may consist of bone dust, leather clippings, hoofs mixed with salt, or charcoal powder. Care must be taken to give the forgings good support among the material, so that they shall not become distorted by their own weight while at a red heat. When the box is filled with alternate layers of metal and of material, the cover is put on and luted with fireclay to make it nearly air-tight. It is essential that air be excluded. Then it is placed in a fire, or, preferably, in a reverberatory furnace, for from ten to thirty-six hours. The time during which the box is exposed to the heat of the furnace mainly regulates the depth to which the metal will be hardened. The chemical activity of the hardening agents, however, influences the result. The addition of powdered yellow prussiate of potash is often an improvement. The forgings are turned out into cold water, and are thus hardened to a depth which ranges from $\frac{1}{64}$ in. to nearly $\frac{1}{8}$ in. But in the same forgings the depth of the hardening will not be quite uniform. For light articles, of course, a mere film of surface

hardening is enough; for heavy work, the steely casing should penetrate to nearly $\frac{1}{8}$ in. Since hardening distorts the work, the minimum amount of penetration that is consistent with the purpose for which the forgings are required should be imparted to them—$\frac{1}{16}$ in., or a bare $\frac{1}{16}$ in., may be taken as a good average. The distorted outlines have to be corrected with an emery wheel or with emery paper.

Cast Steel Hammer, Hardening.—To harden the faces of a cast-steel hammer that is several pounds in weight, make the hammer red hot all over, then grasp it with a pair of tongs through the eye; slack one face of the hammer for about $1\frac{1}{2}$ in. up until quite cold in water, then slack the other face for the same distance up, thus leaving the centre of the hammer hot to bring the faces to the right temperature for hardening. When the faces are cooled out, rub them bright with sandstone, and when they are of a deep straw colour cool them alternately in the water to arrest the softening process, and so continue until there is not sufficient heat in the centre of the hammer to make any difference to the faces. By this means the faces will be hardened and the eye of the hammer left soft. If there is not sufficient heat in the centre of the hammer to bring the faces to the desired colour, a piece of hot iron should be placed through the eye.

Masons' Chisels, Hardening.—In fire-sharpening tools of cast steel, great care should be taken to hammer all sides alike, for if one side is hammered more than another it will have a tendency to spring in hardening. Again, steel, when being hammered, should be treated as hot as it will stand until finishing, and should be hammered until almost black hot, as it sets the grain finer, and gives the tool a better edge; care must be taken that the steel is not over-heated or burnt, as the cutting edge is then spoilt. The tempering of masons' tools will depend on the hardness of the stone they have to cut. In practice, the smith judges of the temper by the colour assumed by the bright steel when heated. This colour undergoes a series of changes as the temperature rises, and is a sufficient guide in tempering to the required hardness. The most highly tempered steel is of a pale straw colour, this passing in succession through yellow, brown, purple, and blue, the last named being softest. To temper the tool, the steel is reheated to a cherry red, and the cutting edge gently immersed for a second into cold water, and removed; it is then rubbed bright with a piece of gritstone until the required colour comes down, or shows itself, when it is plunged into cold water and left till cold.

Mill Bills or Picks, Hardening and Tempering.—Mill bills cannot be tempered all alike, owing, no doubt, to the different qualities of steel used. For instance, some will only stand when cooled right out in water and not let down at all, whilst others require to be let down from the lightest of straw colour to a deep blue. When making new mill bills, it is well to use a good brand of ordinary cast steel; then the bills, when hardened and let down to a medium straw colour, stand all right. When making tools of this description, the following points should be borne in mind: Do not over-heat the steel; do not hammer it out at too low a heat; and when dipping to harden, be sure to have the part that is to be tempered of one uniform heat before plunging it in either water or oil.

Reamer, Hardening.—To harden a long reamer without warping, grip it in a pair of tongs and suspend the reamer and tongs by means of a string twisted tight. When the reamer is heated properly, hold it—suspended perpendicularly by the string in one hand, preventing it from turning with an implement held in the other—over the tub of cooling fluid, and when all is ready, let go, allow it to revolve rapidly, and dip at the same instant. Reamers, taps or any tool hardened in this way will be practically straight, says a correspondent of the "American Machinist."

Springs, Tempering.—The springs should be raised to an even red heat, not too high, to prevent any risk of cracking, and then quenched in lukewarm water. They should next be placed in a ladle containing sufficient tallow to cover, which should be heated till the tallow burns, and then allowed to cool out. A small spring may be tempered

by heating to a cherry red and plunging in cold water. Then hold it over a small fire until warm, and cool with tallow, burning off the tallow over the fire, finally cooling in water. The following is a method which has been given for tempering revolver springs. Heat the springs to a cherry red, and plunge in linseed oil. Then hold the spring over the fire, and allow the oil to burn away; this should be repeated three times, and draws the temper as desired. The spring should finally be plunged in oil. In heating it is advisable to use an oven if the spring is liable to lose its shape, while stiff springs—such, for example, as springs for vehicles—may be heated in a covered forge. The blueing or tempering of spiral springs is done generally after the springs are formed, coiled, or bent into the required shapes, in order to increase their stiffness and staying ability. The best—but also the most costly—blueing is done by a molten lead dip, because lead can be kept at a uniform heat and gives the most even temper. Ordinarily, several hundred-weight of springs are blued at one time in large blueing ovens, heated by liquid fuel or gas, and the blueing is denoted by colour and test. The heat of the ovens is about 700° F. for jig, spiral, and hot-wound springs, and it takes from twenty minutes to half an hour to effect a sufficient blueing. Blueing close-wound springs weakens them; blueing open-wound springs stiffens them.

Taps, Hardening and Tempering.—Heat the taps slowly to a cherry red in a charcoal fire, and then dip them, quite perpendicularly, into warmed clean water. When the tap is cold it may be removed from the water and cleaned at the stalk and flutes by stone or emery cloth, and then warmed in an iron tube until of a dark straw-yellow or brown colour. This tube should be three or four times the diameter of the tap and of about half the length, the wall thickness being equal to the diameter of the tap. It may be placed in the fire and heated to a cherry red, then withdrawn. The tap should be passed up and down this tube, and slowly revolved until evenly heated to the required colour. The shanks are often lowered to a deeper colour than the threads of the tap, in this way gaining in strength. Another method is to temper the taps in heated sand. Yet another way is to employ a hot plate of iron. On this, after being hardened, the tap is laid, and when a dark blue appears on the squared end and shank, that portion is quenched. The tap is again placed on the plate, and, when the light chestnut-brown colour appears, the threaded part is quenched. Sometimes the taps are heated to the required colour and immersed in oil till cold, thus dispensing with the hardening portion of the process. For good results the tap must be evenly heated.

Harness

Black Dye for Renovating Harness.—After well cleaning the harness, give it a coat of dye made as follows: 1 lb. of extract of logwood, ½ lb. of bichromate of potash, 1 oz. of copperas, and 1 gal. of water. Dissolve and apply; then add a coat of jet made of treacle 8 parts, lamp-black 1 part, sweet oil 1 part, gum arabic 1 part, isinglass 1 part, and water 32 parts (by weight). Or a suitable waterproof paste may be made by dissolving a quantity of lac in alcohol and colouring with lampblack. Apply with a sponge.

Black Harness Oil.—(1) Mix well together 1 gal. of neat's-foot oil and ¼ lb. of lampblack. Put the lampblack into any vessel large enough to take the two ingredients, and mix it with a small portion of the oil, then slowly add the oil till the whole is of an even consistency. (2) Melt 3 lb. of pure tallow without letting it boil, and pour in gradually 1 lb. of neat's-foot oil. Stir continually till cold, so that it will be thoroughly amalgamated, or else the tallow will harden in lumps. Then add bone-black to colour it. (3) To 1 gal. of neat's-foot oil add 2 lb. of bayberry tallow, 2 lb. of beeswax, and 2 lb. of beef tallow; dissolve in a pan on a slow fire, then add 2 qt. of castor oil and 1 oz. of lampblack. Strain away the sediment, and keep in pint tin bottles. This dressing is waterproof, and renders the harness soft and pliable.

Blacking for Harness.—(1) To make a good harness blacking that can be finished with a brush, take beeswax, ½ lb.; ivory

black, 2 oz.; spirit of turpentine, 1 oz.; Prussian blue, ground in oil, 1 oz.; and copal varnish, ½ oz. Gently melt the wax, and stir into it the other ingredients till the whole is well amalgamated; then, before the mixture is quite cold, make it into balls or pieces of a suitable shape, and when well set, it is ready for use. To use, rub a little upon a brush, and coat the harness well with it; and to finish, polish with a very soft brush, or even a piece of old silk. All dust or dirt should be removed from the harness prior to using, or it will be a cloudy instead of a bright finish. (2) Melt 1 lb. of mutton suet and 3 lb. of beeswax, and when melted stir in 3 lb. of sugar candy, 1¼ lb. of lampblack, and ¼ lb. of indigo in powder. When the whole has been thoroughly mixed by heating and stirring for an hour over a slow fire, add 2 pts. of oil of turpentine. (3) A harness blacking that will remain soft for a long period will not give so brilliant a polish as a blacking that loses its moisture quickly. The two things are antagonistic. Melt and mix together 2 oz. of beeswax, 4 oz. of mutton suet, 12 oz. of sugar candy, 1 oz. of soft soap, 2 oz. of glycerine, 2 oz. of ivory or bone black, 2 oz. of indigo finely powdered; then add ½ pt. of turpentine. Keep the polish in tightly covered tins; exposure to air tends to harden the polish. (4) To be applied with a sponge. Mix together treacle 8 parts, lampblack 1 part, sweet oil 1 part, gum arabic 1 part, isinglass 1 part, and water 32 parts, all by weight. When cold, add 1 oz. of spirit of wine. If the preparation is hard when being used, place the vessel containing it in hot water to get thoroughly warm. In warm weather this is not necessary. Add 1 pt. of turpentine after all the other ingredients are well mixed, but before putting in the spirit of wine.

Brown Harness Dressing.—Take 3 lb. of spermaceti wax, ½ pt. of olive oil, 1 lb. of pure lard, and a little tincture of annatto and turpentine. Melt the first three, and let them simmer a few minutes; then add sufficient turpentine as it cools to form a soft paste, and tincture of annatto sufficient to give the tone desired. The mixture should be kept in closed tins. To use the dressing, first clean the leather, then apply with a piece of felt or woollen rag, rubbing it well all over, and finish the polishing with a clean duster.

Oiling Harness.—A good method of oiling harness is to unbuckle it, lay it on a bench or table, and then to wash each part well in lukewarm water to which has been added a little potash. Scrub well with a coarse brush until all grease and dust have been removed. Work the pieces well under the hand until they become supple, and do not apply the oil until they are. Let the parts dry slowly, and when just moist, oil them. Cod liver oil is the best for the purpose; and rats and mice will not touch a harness treated with this. Hang up, and when it is dry, rub well with a soft rag.

Polish for Harness.—(1) Harness that has been spoiled by being coated with layers of blacking must first be well washed with warm water and soft soap until the grain of the leather is quite clear again. When quite dry, apply with a brush a mixture made as follows, which gives a patent leather appearance, and will resist wet weather, etc. Place in a glazed jar by the fire 5 parts of colophony, 2 parts of mastic, 5 parts of sandarach, 20 parts of shellac, and 5 parts of Venetian turpentine. When dissolved, add 1 part of lampblack and 100 parts of spirit of wine. Well stir all the ingredients together, and keep airtight when not in use. (2) Break up 4 oz. of glue in small pieces, then pour over this 1 pt. of vinegar, and allow to remain until dissolved. Next take 2 oz. of gum arabic and ½ pt. of best black ink; let this also dissolve. Place 4 dr. of isinglass in sufficient hot water to cover it, and let it remain in the oven until dissolved. Add another ½ pt. of vinegar to the glue solution, place it on a slow fire (but be sure not to let it boil), and keep stirring for a few minutes. Now add the gum solution, and also the isinglass; stir well and thoroughly mix. When cold, the solution is ready for placing in tins or small jars. Apply with a sponge. This dressing keeps the leather fresh and nourishes it.

Renovating Brass-mounted Harness.—Below is explained how to improve the ap-

pearance of brass-mounted harness that has part of the brass worn off. The buckle tongues may be replaced by knocking off the heel of the tongue from the lower bar of the buckle which it works upon; now clench on the new ones. The hames must be replated with sheet brass. The shoulder tugs must be removed by ripping the stitches between the tug loop and the iron clip connecting it with the hame. By this means the lay of leather can be raised. Passing through the clip and the centre piece of leather are two rivets. File the burr off the rivet near the eye of the clip first, as this doubtless holds the lower layer of leather; the second rivet may then be knocked out and the clip removed. If the clips are much worn, get a new pair. The prongs of new clips are left open sufficiently to pass the lower half through the eye of the hame. The longest prong must be at the top, and this is passed above the centre layer of leather with the short prong beneath it. The two prongs are then brought close to the layer of leather by placing them in a vice and screwing them down tightly. They are then riveted together again. Of course, this must not be done until the hames have been replated. To do this work, cut some thin sheet brass into strips wide enough to fold over the rounded surface of the hames, and cut wider pieces for the draughts. The hames are well cleaned, the surfaces to be plated are covered with a thin layer of solder, and one surface of the sheet-metal pieces is similarly treated. The strips are then joined to the hames by the application of heat. When all parts have been replated the clips may be passed through the eyes of the hames and joined to the tugs, as described above. Finish by stitching together again the layers of leather forming the tugs.

Hatchets

The remarks under the heading "Axe" regarding the shapes of heads apply just as well to hatchets. An axe is swung with two hands, and a hatchet is used with one hand only. The household hatchet is often a chopper or small cleaver, and has a long flat blade. When curved and ending in a point it becomes a "bill," and is useful where a slashing stroke is required.

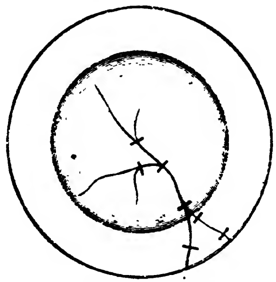
Hats

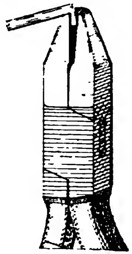
Felt Hat: Altering Shape.—Felt hats are stiffened with shellac; they should be softened by moist steam, and then pressed on blocks. The judicious use of a hatter's iron placed over a damp cloth will lay the fibres and give the slight glossy finish which is seen on felt hats when new. Hatters also use "velures" (that is, small cushions of plush stuffed with some soft material) for laying the fibres and producing a fine finish or "nap."

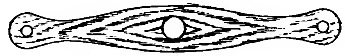
Felt Hat: Cleaning.—For renovating a felt hat, remove the dust with a hat brush, then well treat the hat with benzoline (away from any light), applied with a sponge and gently rubbed in with it. After drying, the hat should be held in front of a fire and carefully smoothed with a velvet pad, working the pad round the hat from left to right; every part of the hat should be smoothed in this way. For cleaning a white felt hat, brush the hat all over several times with whiting mixed to a paste with benzoline, using a stiff nail brush; then hang the hat on a hook (away from any flame) to dry. When dry, brush out all the whiting with a stiff hat brush. Grease spots on hats should be well rubbed with a rag dipped in benzoline. For grey hats, mix a little light magnesia with the liquid and brush out the powder after drying.

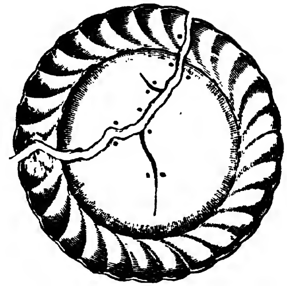
Felt Hat: Dyeing Black.—The dyeing of felt hats after they are made up is not a satisfactory operation, but the following is the method for dyeing felt black: Boil logwood chips with just sufficient water to cover them, and strain off the decoction. Also prepare a solution of sulphate of iron (copperas), to which add a small quantity of sulphate of copper. Now sponge the hat with the logwood extract, then with the copperas, and allow to dry; if not sufficiently black, repeat the operation and again dry; finally sponge with clean water to remove the small quantity of white material which usually appears on drying.

Felt Hat: Glossing.—A gloss for felt hats may be made by dissolving 1 oz.

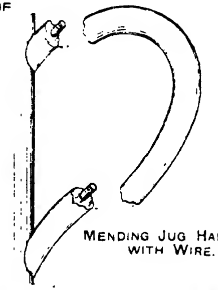

POSITION OF RIVETS FOR V-PIECE BROKEN OUT OF PLATE.

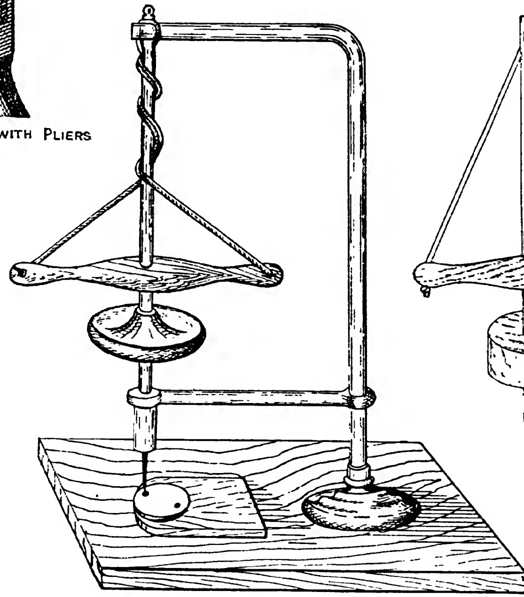

RIVET FORMED WITH PLIERS

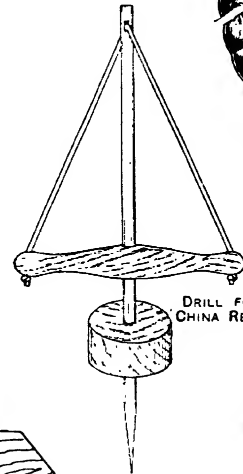

DRILL ARM.

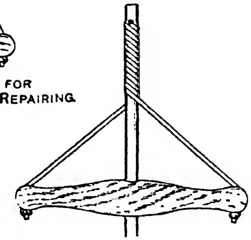

POSITION OF RIVETS ON PLATE

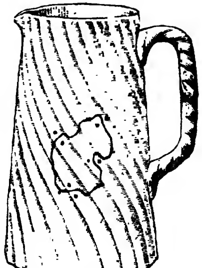

WIRE RIVET WITH ENDS NOTCHED.

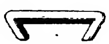

MENDING JUG HANDLE WITH WIRE.


UPRIGHT DRILLING APPARATUS SUITABLE FOR CHINA OR GLASS

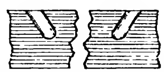

DRILL FOR CHINA REPAIRING.

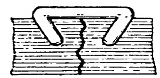

METHOD OF WORKING DRILL

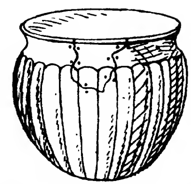

POSITION OF RIVETS ON JUG.


RIVET


DIAMOND BIT.


SECTION SHOWING POSITION OF RIVET HOLES.


RIVET IN POSITION.


POSITION OF RIVETS ON VASE.

CHINA AND GLASS RIVETING

of shellac in ½ pt. of methylated spirit and colouring with aniline black soluble in spirits. This should be applied sparingly with a rag and the hat then ironed, but the hat itself should not be held over the stove. Another method is to place a piece of beeswax on a soft piece of flannel, and iron the wax into the flannel with a hot iron. While the flannel is warm rub it all over the hat, then iron the latter, and polish with a felt pad. These methods should be tried on an old hat first until experience with them is gained.

Felt Hat: Mending.—To mend a cut or a hole in a felt hat, cut out a piece of soft felt, similar in colour to the hat, to cover the cut or hole. Glue the edges, and when the glue is nearly set the piece of felt should be pressed on the hole in the inside of the hat. By teasing the piece of felt with the point of a needle its fibres may be raised, so as to hide the join, and the hat may then be ironed on a block. The result will be only fairly successful.

Felt Hat: Removing Varnish Stains.—The stained part should be repeatedly damped with alcohol, benzine, or turpentine, and finally rubbed well with a piece of coarse cloth until the stain disappears.

Felt Hat: Reviving.—Felt hats are much improved in appearance by heating and rubbing in one direction only with a warm velvet pad. They are also greatly improved by rubbing with a warm cloth on which a very little beeswax has previously been melted; only just sufficient wax should be used to bring up a dull gloss when the velvet pad is applied: the employment of too much wax would cause greasy patches to show. The following is a recipe for a reviver for black felt hats:—Take 1 lb. of logwood chips and boil with 1 qt. of water for two hours; strain, add a little water to the chips, and again boil and strain; make the total up to 32 oz. if below that bulk. Dissolve in the solution 1 oz. of chromate of potash (not bichromate), when the reviver is ready for use. Another is made by diluting one pennyworth of liquid ammonia (·880) with three times the amount of water; then add some good black ink.

Felt Hat: Softening.—Soak the hat for several days in methylated spirit or in benzene (coal-tar naphtha); but it may not be possible to wear the hat after it has been softened. It would be advisable to experiment first on an old hat.

Felt Hat: Stiffening.—The spirit preparation used in stiffening felt hats is made from shellac and methylated spirit. The quantities are 4 lb. of shellac to 1 gal. of spirit. These are macerated in the cold, and stirred from time to time until all the solid lac has dissolved. The preparation is diluted with more spirit as required, but the amount necessary is a matter of experience. The stiffening is applied with a stiff brush, the quantity used varying with the stiffness required. The hats are then placed upon blocks in a wooden chest, and carefully steamed for twenty minutes. The steaming removes the stiffening of the surface, leaving it clean. The hats are removed and heated carefully in a warm oven at a temperature not exceeding 180° F. to thoroughly dry them. They are then removed, and allowed to cool and harden.

Felt Hat: Stretching.—Warm the hat inside by placing it near the fire, and stretch it with the hands; it would be better, however, to stretch it on a block and, after making it hot, leave it on the block all night.

Panama Hat: Cleaning.—To clean a Panama hat, first give it a good scrubbing with Castile soap—any good white soap will do as well—and warm water, using a nail brush to get away the dirt. A little ammonia in the water materially assists the scrubbing process. To prevent the hat getting stiff after drying, first rinse it in water in which a little glycerine has been mixed. Immerse the hat completely in the rinse water, moving it about to get rid of all traces of dirt. When the hat has been thoroughly rinsed, press out the surplus water with a bath towel, and let it rest on the towel when drying.

Silk Hat: Cleaning and Renovating.—(1) Rub the hat in the proper direction with a velvet cloth wetted with benzine to remove the stains, then dry by using a soft cloth in the same manner. (2) First brush the hat well, then go over it with a warm iron—a hatter's iron is best, but a small flat iron may be used—and finish off by smoothing with a pad made of velvet

and filled with bran or sawdust. The nap must be kept quite straight during the process.

Silk Hat: Ironing.—The materials required for ironing silk hats are a set of irons, three iron blocks, and a gas stove. The irons are long, narrow, and flat for ironing the hat body, and thin and curved for ironing the brim. The blocks are of smooth iron set in wood blocks; one is not unlike a shoemaker's last, but it has a curved upper surface. Upon this the hat body is ironed. The top of the hat is ironed on a flat block, while the brim is ironed on a block curved to the shape required.

Straw Hat: Altering Shape.—After cleaning, place the straw hats in warm water to soften, then dip for a few seconds in a thin size made from gelatine and water; they should then be forced on shaping blocks and allowed to set hard.

Straw Hat: Black Varnish for.—(1) Dissolve two or three sticks of best quality black sealing-wax in 1 gill of methylated spirit. Apply with a camel-hair brush in a warm room. (2) On a larger scale, dissolve 4 oz. of seed lac, 1 oz. of resin, 2 oz. of Venice turpentine, and ½ oz. of gum mastic in 1 pt. of methylated spirit. The black colour is imparted by adding to the above quantity ½ oz. of aniline black spirit dye. (3) Dissolve 1 lb. of shellac in ½ gal. of methylated spirit, add 3 oz. of camphor, 2 oz. of lampblack, and 1 oz. of Prussian blue. Stir well at each addition, strain through a fine hair sieve, and then bottle. Paint the hat with a soft hair-brush, and dry in a place free from dust. It should yield a fine polish.

Straw Hat: Bleaching.—The only requisites are 1 oz. of powdered sulphur (flowers of sulphur) and an old box or packing case. The method of procedure is as follows: Secure a box or packing case, fairly airtight, 2 ft. or 3 ft. deep and large enough to allow the hat to lie on the bottom of the box without being bent out of shape. Remove the ribbons and trimmings, and scrub gently with soap and warm water until all dirt, dust, and grease have been removed. Rinse thoroughly to remove soapsuds, etc. Keep in shape, drain off the water, and more or less dry the hat. Secure a small phial cork, and cut it into pieces about ¼ in. long. Pass tin tacks through the brim and the bits of cork into the bottom of the box in order to keep the hat from falling when the box is turned upside down. The corks will be between the hat brim and the bottom of the box, leaving a space the depth of the corks between the hat and the box, and allowing air and fumes to circulate there. The top of the hat will, of course, lie away from the bottom of the box. If the box is not deep enough to allow at least 18 in. or 20 in. between the top of the hat and the sulphur, take the box into the garden, or any little plot of ground, and dig away the earth to give the required depth. Obtain an old saucer, broken tile or slate, or lid of a tin box; on this lay the sulphur, and above it place a similar broken saucer, slate, plate, or tin, supported on three or four little twigs stuck in the ground, which will prevent the flames of the burning sulphur from singeing, burning, or discolouring the hat immediately above the flame. Take a "live" cinder in the tongs out of the fire, put it in the sulphur, and quickly place the box with suspended hat over the now burning sulphur in the hole. If the box is not air-tight, throw over it a rug or old blanket and also heap the earth round the edges of the blanket to keep the fumes in; or, better still, heap the earth round the edges of the box on the top of the hole with the same object. Leave all thus for ten or fifteen minutes. Examine the hat after this time to see if it is sufficiently bleached; if not, wash it again in soapsuds, rinse in clean water, drain, and again fume the hat with sulphur, placing the corks in another position. It rarely, however, happens that it is necessary to do this again, unless the sulphur has not burnt out. Then remedy any parts that may be misshapen and allow to dry thoroughly. Replace the trimmings, if good enough, and the hat will be found to be clean and presentable, and as white as when first bought.

Straw Hat: Cleaning.—The surface dust and dirt may be removed by rubbing the

hat with the soft crumb of a thick piece of bread. If further cleaning is required, remove the lining, and well scrub the hat with warm soapsuds; shake, and pass once or twice through clean warm water. The hat will be improved with a little size, which may be prepared by dissolving ½ oz. of pale glue in 10 oz. of hot water; this should be applied all over with a clean rag, and the hat allowed to dry. A new ribbon will then be a further improvement. Straw hats gradually darken by exposure to the sun; the yellowness can only be removed by bleaching.

Straw Hats: Stiffening for.—Thin glue size applied warm is generally used. Ordinary glue size may be employed for coloured straws, and parchment size for white straws. For black straws, add a little aniline black to the size to colour it. Spirit varnishes may also be used for stiffening straw hats; ordinary French polish, diluted with methylated spirit, will be suitable.

Hearth Tiles, Fixing (*see* Tiles)

Hearthstone

Hearthstone squares are sold at such a low price that it would not pay to make them at home. The moulds should be made of wood in the form of boxes, with taper sides to facilitate removal of the squares; the boxes should be without tops or bottoms. Mix equal parts of whiting and plaster-of-Paris, and add sufficient water to form with it a stiff mass like dough. Place the wooden moulds on a flat board, and fill with the mixture, striking off flat with a wooden scraper; then remove the moulds and contents to a dry floor and stand on edge. Next day turn the mould over and tap out the cakes, which should be stacked in heaps in open fashion, so that air may get to them to dry them.

Heating Apparatus

The unpleasant smell from heating apparatus when it is employed for the first time after a long rest is well known; the smell exists even if the temperature does not reach the boiling-point of water. Many reasons for this have been put forward, and it frequently has been asserted that the smell is due to a dry distillation of the dust particles, though this could take place only at temperatures greatly exceeding those likely to arise in the usual forms of low-pressure steam apparatus, or those depending on the circulation of hot water. In order to arrive at the real cause, exhaustive examinations have been made in Germany of the different kinds of dust deposited in dwellings and school buildings. The results of these examinations as recorded in the "Gesundheits-Ingenieur," and published as a foreign abstract by the Institution of Civil Engineers, have shown a fine dust, collected with due precautions, to consist largely, and in some cases wholly, of very minutely divided horse-dung. Moreover, the dust found in the cold pipes always contains a large proportion of moisture, and is rich in micro-organisms. When the apparatus is first set in operation the warmth induces these organisms to vegetate in great numbers, and results in setting free large volumes of ammonia. This gives rise to the unpleasant smell, and has an irritating effect on the mucous membrane. In order to avoid the smells, all that is needed is thoroughly to clean the pipes and coils before the fires are lighted.

Heelball (*see* under Boots and Shoes)

Hektograph

To make a gelatine copying pad, soak in cold water 2 oz. of pale gelatine glue until it has the appearance of a thick jelly; then place it in a piece of fine muslin and squeeze away any surplus water that has not been taken up by the glue. This should be put in a thick earthenware vessel with 10 oz. of glycerine, and should then be placed in an oven and simmered with a gentle heat, stirring at intervals to prevent burning to the bottom of the vessel. After thorough mixing, add ten drops of oil of cloves, which will prevent the preparation turning mouldy. The mixture should next be poured into a shallow tray, 12 in. square, with sides 1 in. high, and stood in a cool, level place, so that the surface of the pad will set with an even surface, free from blisters. It generally sets in about four

hours, when it is ready for receiving the copying matter (which must be written with a special ink). Before using, rub the surface of the pad with a damp sponge; then place the written matter gently on the pad face downwards. The paper should be gently rubbed and allowed to remain for a few minutes. On removing the paper there will be found on the pad a perfect impression of the written matter. By simply placing a blank sheet of paper on the pad and lightly drawing the hand over the back there will be found an exact facsimile of the original copy. When sufficient impressions have been taken from the pad, the surface should be washed with a sponge until most of the ink has disappeared. The pad should then be remelted over a slow fire or oven, and if the mixture assumes a blue colour, a little powdered whiting, which takes up the ink stains, may be added.

Improved Hektograph.—For instantaneous copying purposes, the following composition is an improvement on the gelatine graphs so much in vogue. It resembles putty in a soft state, and does not harden when exposed to air. If accidentally cut or broken, it will not require melting to get rid of the defect, as it may easily be smoothed down with the finger or a small piece of wood. The ingredients are 1 lb. of whiting and 4 oz. of pure glycerine. Reduce the whiting to fine powder; mix 8 oz. with all the glycerine, and beat it up thoroughly. About twelve hours later, add the remaining powdered whiting. It will probably work rather stiffish, and seem too dry, but if placed aside for a short time the glycerine will spread through the whole of the whiting and render it perfectly moist. Turn the dough-like mass into a shallow tin, smooth it nicely down with a round hardwood ruler till a faultless level surface is obtained, and the copier is then quite ready for using. If the glycerine comes to the surface after standing a short time, sprinkle a little powdered whiting over it, roll up the mass, thoroughly knead it, and again spread it out smoothly. Repeat until the composition is firm, but not absolutely dry. The copier will be useless if the glycerine is repeatedly wiped away. For use at lengthy intervals, keep the copier well covered; and if the top is too wet for use, do not remove the moisture, but beat up the whole of the composition, and spread it out evenly again. If it is too dry, add a little glycerine. Any ordinary graph copying ink will do. Write on smooth paper, and transfer to the composition in the usual manner, rubbing the back of the paper gently. Sixty excellent copies may be produced, and a considerably greater number of weaker specimens. Wipe the residue of ink from the copier with a wet cloth or sponge, spread a sheet of white paper over the composition, pass the hand firmly across several times, to take up the aqueous moisture, peel off the wet paper, and another letter, etc., may be immediately proceeded with.

Ink for Hektographs (*see* Inks).

Using Hektograph.—The following instructions apply to the use of graphs, and especially to the use of the improved graph just described. Graphs on which the original writing is transferred cannot yield a number of copies all equal in strength, as with each impression the quantity of ink on the graph decreases. Therefore, if twelve copies are required, let the first few sheets of paper rest on the transferred writing about twenty seconds; gradually increase the time of contact, letting the twelfth remain about two minutes. To obtain twenty-five copies, proceed as follows: Take the first ten or twelve impressions quickly, and directly they have been smoothed, lift them over the graph. Then allow each succeeding paper to remain rather longer on the graph than the one preceding. By writing with Judson's violet dye, sixty perfectly legible copies can be obtained. Not more than thirty copies can be expected from an original written with Stephens' liquid ebony stain, and it is well to limit the number to twenty-four or twenty-five. Always write the original on thick, smooth-surfaced paper. Paper of a spongy texture must not be used. Keep a good supply of ink always in the pen, which should have a very fine point; Perry and Co.'s ladies' pens, fine points, are recommended. Firm, thin lines give best results. Put a sheet of clean paper on the graph, and

pass a flat stick over it to make a perfectly smooth surface. Directly the writing loses its wet appearance, place it face downwards on the graph; be certain that every portion of the writing comes in contact with the composition, and leave it so from ten to fifteen minutes. This length of contact while transferring does not apply to gelatine graphs, into which the ink rapidly sinks, whereas in the improved graph the ink is inclined to get to the surface. The ink will not transfer so readily if dry and hard when placed on the copier. Get ready the sheets of paper whereon the impressions are to appear; gently remove the original from the graph; take the first copy quickly, and examine it closely to discover faulty words caused by air bubbles or depressions forming on the surface of the graph. Note the exact position of the fault on the composition, proceed with the second copy, and, while the paper is on the graph, press gently on the defective parts with a knife handle or other hard smooth substance. This will level the composition. When sufficient impressions have been obtained, wash off the writing with a wet cloth or sponge. Remove any excess of water with clean white paper. Avoid using blotting-paper and like substances for this purpose. To gain experience for taking impressions of a larger kind start with something of a postcard size. Put a strip of paper at one end of the graph as a guide for placing the sheets of paper evenly over the writing. Let one edge of a sheet lie level with the guiding strip, and draw a hard wooden ruler or other smooth piece of hard wood over the top of the paper to ensure every part touching the writing with equal pressure. The writing may be in two colours, and copied simultaneously, but it is more difficult to time the length of contact necessary than when copied separately. It should be stated that much depends on the nature, quality, and colour of the ink used.

Hemp Ropes (*see* Ropes)

Hinges

Many varieties of hinges are used. The general construction of the simplest kind, the butt hinge (Fig. 398), can be understood readily. It consists of two flaps moving on a wire pivot. The side shown in Fig. 398 is known as the front, the reverse as the back. By back, however, is often understood only the rounded part, which is visible when the hinge is fixed, and the door, or whatever it may be attached to, is shut. In the finer qualities of hinges the backs are often polished and lacquered; the fronts also may be finished in the same way. The quality varies considerably, both in weight of metal and general style. Roughly speaking, a good hinge is one in which the parts work smoothly against each other without twisting or straining. It is obvious that the joint of a hinge is usually divided unequally; for example, in Fig. 399, where

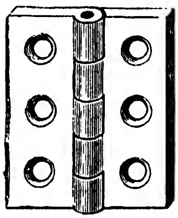


Fig. 398.

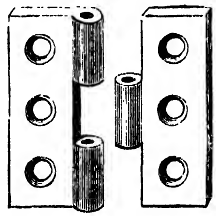


Fig. 399.

Figs. 398 and 399.—Butt Hinges: Together and Apart.

the two flaps of a butt hinge are shown apart, one of them has two projections, and the other only one. The side with the even number of projections is called the double, and the other the single. The custom is not invariable, as in some hinges each side has the same number; in "lift-off" hinges the reason for this is obvious. Hinges are made of brass, or of wrought iron or cast iron. Brass is used solely for the sake of its appearance; it is a bad material, on account both of its softness and of its tendency to corrode. Probably the best kind of hinge is formed of cast-iron with steel pins. It is mistaken economy to use very narrow hinges. The leverage on the screws is materially reduced by using wide hinges, and the additional cost is not worth considering. Swing-doors are usually hung with a special contrivance

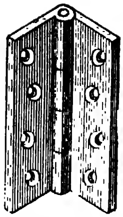


Fig. 400.

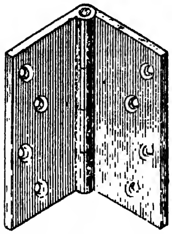


Fig. 401.

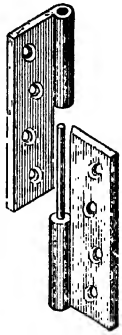


Fig. 402.

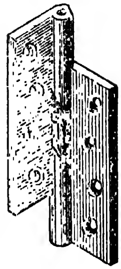


Fig. 403.

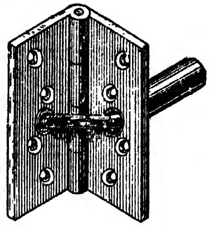


Fig. 404.—Gerrish's Single-action Spring Hinge.

Fig. 400.—Butt Hinge.

Fig. 401.—Broad Butt Hinge.

Fig. 402.—Lifting Butt Hinge.

Fig. 403.—Rising or Skew Butt Hinge.

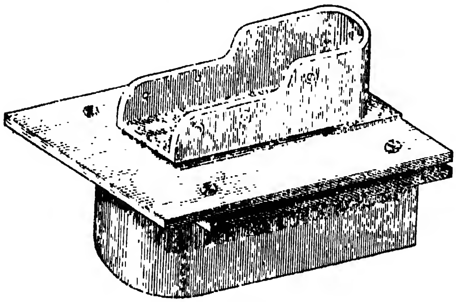


Fig. 408.—Floor Spring Hinge.

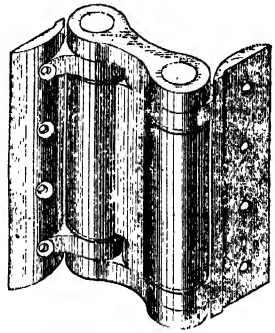


Fig. 406.—Cartland's Double-action Spring Hinge.

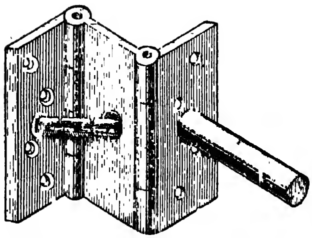


Fig. 405.—Gerrish's Double-action Spring Hinge.

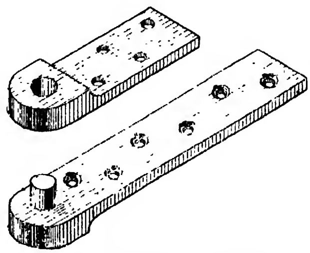


Fig. 407.—Centre-pin Hinge.

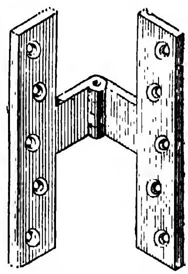


Fig. 409.—H Hinge.

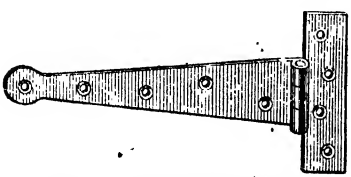


Fig. 410.—Cross Garnet Hinge.

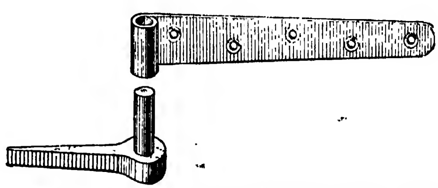


Fig. 411.—Hook-and-eye or Hook-and-strap Hinge.

at the bottom. The door fits into a metal shoe, which works on a pivot. This pivot is regulated by a spring, which is fixed under a brass plate flush with the floor. These are expensive goods, but when well made and properly fixed they will last for

Cross-garnet hinges are used for the smaller kinds of outhouse doors; and strap hinges, with hook-and-eye action, for the larger doors and gates.

Names and Sizes of Door Hinges.—The hinges illustrated are a selection of some

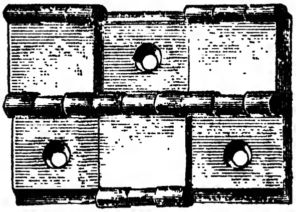


Fig. 412.

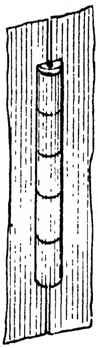


Fig. 413.

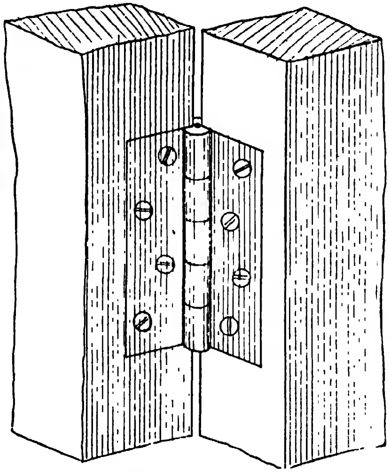


Fig. 414.

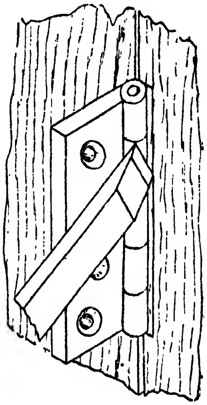


Fig. 417.

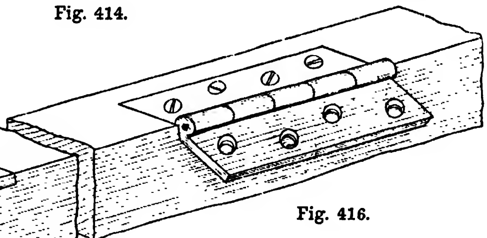


Fig. 416.

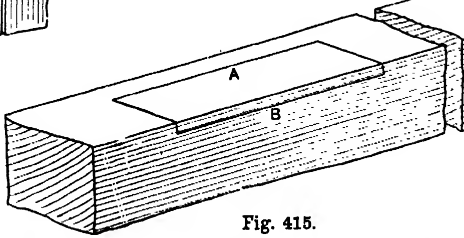


Fig. 415.

Fig. 412.—Screen Hinge Open. Figs. 413 and 414.—Hinge let in, with Centre on Centre Line of Joint. Fig. 415.—Hinge Set Out on Door Stile. Fig. 416.—Flange of Butt Hinge Secured. Fig. 417.—Marking Thickness of Hinge Knuckle.

years. About the best kind of hinge for a door that is intended to be self-closing is that known as a "rising butt." The part which is fixed to the door has a spiral action in an upward direction when opening, and thus the additional advantage is gained of a slight rise in the door, by which it is enabled to clear the carpet when opening, and is closer to the floor when shut.

of the kinds ordinarily in use for doors. Fig. 400 is a view of the butt in general use. Fig. 401 shows a broad butt, or projecting butt as it is sometimes called, from the fact that it projects some distance beyond the joint of the door and architrave, to allow the door to open well back and clear the architrave. Fig. 402 shows a lifting butt, which is used in cases in which it is desired that a

door may be taken away temporarily from its opening without the necessity of taking out screws, etc. Fig. 403 is a rising butt, sometimes called a skew butt. The object aimed at in the use of this butt is to make the door rise as it is opened, so that it may clear carpets, etc., without leaving a wide space at the bottom of the door when it is closed. The sizes of the above hinges vary from 1 in. to 6 in. At Fig. 404 is illustrated Gerrish's single-action spring hinge, used where it is necessary that a door should close by itself and remain closed; and at Fig. 405 is shown a double-action spring hinge by the same maker. Fig. 406 is a view of Cartland's patent double-acting spring hinge. The last three mentioned vary in size from 3 in. to 5 in. Fig. 407 gives views of a centre-pin hinge, generally used at the top of doors, and in connection with the floor spring hinge illustrated at Fig. 408. These latter hinges are made both single-acting and double-acting. The object of using double-acting spring hinges is to allow of a door being pushed or pulled open, and then for it to gradually swing into its proper closed position. Fig. 409 is a view of an H hinge; Fig. 410 of a cross garnet; and Fig. 411 of a hook-and-eye or hook-and-strap hinge. Each of these is used for commoner purposes, such as ledge doors, etc. Fig. 412 shows the screen hinge.

Putting on Hinges.—Some workers let in hinges so that their centres come to the centre of the joint of the door (*see* Figs. 413 and 414); then when the door happens to be left slightly open, people cannot peep in and see all over the room. This plan, however, causes the joint of the door to come so close that the door will not open much more than square before it binds on the mouldings, and very soon somebody pushes it back too far and the door is partly torn from its hinges. It is therefore, preferable (for the door of a room) to keep the top hinge out nearly $\frac{1}{4}$ in., and the bottom one $\frac{1}{8}$ in. more. Set out the hinges on the door stile (the upright side piece) as shown in Fig. 415, the lines A and B being made with a marking gauge. Saw and pare out, and then screw the flange of the butt in position, as shown in Fig. 416. Its surface should be just flush with the edge of the door. Next offer the door in position, pushing a wedge underneath until a joint about the thickness of a penny is obtained at each side and at the top. Mark the position of the hinges both at top and bottom with a chisel; then with the chisel mark the thickness of the knuckle on the edge of the jamb, as shown in Fig. 417. This will give the depth to which to let the hinge in. The other edge of the hinge should not be let in more than its own thickness, and care should be taken to drive the screws in square with the hinge. For packing up a hinge when too much of the wood has been cut away, use some thicknesses of paper or thin cardboard; these do not split as does a shaving of wood.

Holes, Drilling (*see* Earthenware, Glass, etc.)

Horn

Bleaching Horn.—To bleach horn white, try soaking in ammonia solution, and then in hydrogen peroxide. Only light-coloured horn would be suitable for bleaching.

Cementing Horn to Iron.—Dissolve shellac in warm methylated spirit till a semi-fluid mass is formed. The iron should be roughened if possible to give a better grip. Both the iron and horn may be warmed slightly, thinly coated with the cement, and then bound tightly together till the cement has set hard. Canada balsam would also be a suitable cement; it should be baked in the oven till it sets hard on cooling, when it may be powdered, sprinkled over the iron, which should be heated till the cement melts, and the horn slid over the iron so as to exclude all air bubbles.

Dyeing or Staining Horn.—Horn can be dyed by mixing together 5 parts of lime slaked and 2 parts of litharge with a little weak caustic soda solution. This is placed on the horn and allowed to remain for a short time until stained sufficiently. The horn will first become yellow, then brown, and finally black, so that a little must be removed to see how the staining is progressing, and when the colour is deep enough the horn should be thoroughly washed in water. Another method of staining horn is to allow it to soak in a hot solution of aniline dye

until the colour is absorbed. A better result can be obtained by soaking the horn in a weak solution of ammonia to soften it, previous to dyeing. Horn is coloured brown and black by boiling in a solution of lead acetate, and then in a weak solution of ammonium sulphide. A good black stain can be made by boiling logwood and adding a little copperas.

Utilising Horn Waste.—Horn waste can be utilised by the following process: The turnings, raspings, or filings are pressed into a thick mass in a metal cylindrical mould by means of a metal stamper, heat being applied all the time; the mass is then rasped into a fine powder, which is again compressed in the same manner, the process being repeated till the whole attains a sufficient degree of compactness and strength. It is then again rasped and well sifted to remove all the coarser particles. As a rule, horn shavings are worked together with tortoise-shell waste; when made from this combination, articles are less brittle than when of tortoise-shell alone. The articles are made from the fine powder by the following process: The powder is placed in layers between brass plates, and several such layers put under the press and dipped into boiling water; this will make the mass firm and coherent. The plates are then worked up as required, or the articles may be formed in suitable moulds.

Working Horn.—Horn is not dissolved for the purpose of working, as there is no known method of doing this without altering the properties of the horn. It is either turned as for pipe stems, or punched out as for buttons; but it is also more or less moulded by treating with steam and then submitting it to high pressure. Ammonia will soften horn considerably, and in this condition it is more amenable to pressure; the other alkalis dissolve it, converting it into a substance allied to glue. In Sheffield, the horn is first sawn approximately to size with a circular saw, and put into a tank to boil until soft. It is then cut to shape, scraped, and finished for the die. The die meanwhile is being heated, and is then withdrawn, cleaned, a spot of oil dropped in each division, the two pieces of prepared horn laid in position, the die closed, fastened in a vice, and left to cool. The die is now opened, the horn taken out and dressed by paring the edges with a razor blade set in a stout handle, and put under a weight to keep flat.

Horns

Cleaning Mounted Horns.—If the horns are mounted together with the pate, first remove the skin, which will probably be tacked on behind, and place it in benzoline until thoroughly saturated. Then well wash the horns with hot water and soap and soda, using a scrubbing brush. If still discoloured on drying, the horns may be repolished as follows: Having removed the surface polish already existing, also the discoloration, with glasspaper of various grades, from coarse to fine, well rub the horns all over with pumice powder made into a paste with lard oil. Then apply putty powder in the same way and proceed to bring up the polish with a series of cloths, commencing with a coarse one and finishing with a soft one, and lastly the hand. Next dry the hair by well rubbing it with fine sawdust, which can afterwards be shaken, beaten, and then blown out with the bellows.

Destroying Insects on Mounted Horns.—To destroy insects that are attacking the hair of mounted horns, soak the entire skin in benzoline (the common quality petroleum spirit) to which has been added powdered naphthalene, say a tablespoonful to a quart. Having steeped it for about half an hour, remove and brush the hair backwards and forwards in a brisk draught until the benzoline evaporates. The application, to the inside, of a dressing of methylated spirit to which is added a small quantity of perchloride of mercury (a deadly poison), 15 gr. to the fluid ounce, will effectually prevent the recurrence of these pests.

Polishing Horns.—Remove any rough or uneven parts with a spokeshave, then well scrape all over with a cabinet-maker's steel scraper or with the edges at the sides of a woodworker's chisel. When the horn is fairly smooth, go over it with a rasp or file, followed by coarse glasspaper, then finer, then the finest. Now rub briskly

with a piece of rag that has been dipped in oil and then into the dust, etc., which has come from the horns during the scraping and filing. The horns should next be smartly rubbed with a rag dipped in whiting and sulphuric acid or vinegar, then with a rag dipped in oil and putty powder (oxide of tin). Now well rub the horns with a dry cloth, then with crumpled paper, and finally with the bare palm. Two points to be observed are: The rubbing at each stage must be thorough; and between every two steps a good dusting of the horn should be given to prevent the larger particles of the one stage scratching the smoother surface gained in the succeeding stage. A coat of good varnish produces almost as good a result as the tedious polishing.

Horsehair

Bleaching Horsehair.—If white hair is required, the whitest obtainable should be chosen and bleached. The hair should first be thoroughly washed in hot soap and water, then passed through hot clean water and allowed to soak overnight in a bath of hydrogen peroxide rendered alkaline by ammonia; it should then be again put through clean water and slowly dried.

Dyeing Horsehair.—For dyeing horsehair a brown colour, steep it in infusion of logwood. A darker brown can be obtained by steeping it in a solution of permanganate of potash. To dye white horsehair dark blue, well wash the horsehair in hot water and soap to remove the grease and dirt, then run through clean water and dry. Now boil it in a solution of alum and cream of tartar (2 gal. of water, 1 lb. of alum, and ½ lb. of tartar), wring out, and boil in sulphate of indigo (1 gal. of water to 1 lb. of sulphate of indigo); wash and dry. To darken the colour, increase the sulphate of indigo to 2 lb.

Horse's Hoof, Mounting

For mounting a horse's hoof, force back the skin over the hoof so as to expose the bone as far down as possible. With a saw, cut off the bone as low as possible, make a mould from the piece removed, and cast a duplicate in plaster-of-Paris. If preferred, wood or cork may be used instead of plaster, which is rather heavy. Cure the skin by rubbing into it a mixture composed of ¼ lb. of finely powdered burnt alum and 1 oz. of finely powdered saltpetre. Treat the surface where the bone was sawn off and the edges where the skin joins the hoof with a repeated rubbing in of the preservative. When it has dried and hardened, relax the stiffness of the skin by steaming just sufficiently to soften it. Replace the skin, and put the plaster or wooden core in where the bone was. Stitch the top edge very neatly round to a circular piece of leather or other suitable material, and with glue or paste affix an outer covering to conceal the stitches and give a neat finish.

Hydrochloric Acid (*see* Acid)

Hydrofluoric Acid (*see* Acid)

I

Ice

To preserve ice in small quantities by an old but little-known method, it is placed between layers of strong cloth, and cracked with a hammer. Over a common flower-pot a piece of flannel is tied in such a manner that it is turned down funnel-like into the interior of the pot but does not touch the bottom. The pot is placed on a porcelain dish, and it is said that ice can be kept in the flannel funnel for days.

Incandescent Burner (*see* Gas)

Indiarubber

This is the coagulated latex (milk) or juice of a large variety of trees found all round the world in the torrid zone. The latex is obtained by making incisions in the bark and collecting it in tin vessels, and the rubber is separated from the latex by curing over a smoky fire, by adding acetic acid, by exposing to sun and atmosphere, and in other ways. Raw rubber is not of much use, as it becomes sticky with heat. It is this form of rubber which is used for making rubber solution. Rubber is made fit for its exceedingly varied uses by mixing with sulphur (or some other vulcanising agent) and heating for a length of time depending on the kind of rubber required; this process is known as vulcanising.

Difference between Rubber and Guttapercha.—Briefly, whilst rubber is elastic and returns, after stretching, to its original form, guttapercha has its shape altered by stretching. Rubber may come from any one of sixty plants, but there is only one kind of guttapercha plant. This matter is more fully explained under the heading "Guttapercha."

Indiarubber Cement.—A simple solution of pure unvulcanised indiarubber in a suitable solvent (*see* "Indiarubber Solution," below) serves as a cement for uniting rubber to rubber, rubber to metal, rubber to leather, rubber to vulcanite, etc. Guttapercha solution is recommended for cementing rubber to leather; it is made by dissolving guttapercha in sufficient carbon bisulphide to form a syrupy liquid. Both the rubber and the leather should be painted with this liquid, and then held together by pressure until the solvent has evaporated. Another suitable cement for joining rubber and leather is made by melting together 1 lb. of guttapercha, 4 oz. of indiarubber, 2 oz. of pitch, 1 oz. of shellac, and 2 oz. of linseed oil; the mixture hardens by keeping, and requires to be melted for use.

Indiarubber Eraser.—This is lightly vulcanised rubber of special purity. For the preparation of ink erasers, abrasive materials, such as pumice powder, etc., are added to the rubber before vulcanising (heating the rubber already mixed with sulphur).

Indiarubber Solution.—Rubber solution must be made from indiarubber which has not been vulcanised; Para rubber is considered best for the purpose. The rubber should be cut into thin shavings with a very sharp, wet knife. The shavings may be dried, then placed in a dry, wide-mouthed bottle, and covered with coal-tar naphtha, or carbon bisulphide. The coal-tar naphtha is known also as benzol and benzene; it is preferable to carbon bisulphide because it does not smell quite so strong. The bottle should be tightly corked, placed in a warm place, shaken from time to time, and more solvent added as the rubber swells. One ounce by weight of rubber will

take from 15 oz. to 20 oz. by measure of the benzene.

Indiarubber Stamps.—The moulds for rubber stamps are made by setting up type or raised design in a frame and surrounding with a raised edging or ring of metal. Plaster-of-Paris is then mixed to a paste with water and filled into the ring. When the plaster has set hard, the ring is removed and the plaster mould taken off. The plaster mould is now treated on the face with a shellac spirit varnish to destroy its porosity, and when this is dry the ring is put on and sufficient of the rubber mixture put in and forced down with a spatula. When the rubber is sufficiently set, the ring is removed, the rubber stamp taken off, embedded in French chalk in a metal box, and heated in the vulcaniser for the requisite time to cure it. Sunk metal moulds are also used. The proportions of the rubber mixture are rubber 95 parts and sulphur 5 parts. An ordinary kitchen oven would not serve as a vulcanising oven, because there is no means of regulating the temperature. For small work an autoclave is most suitable; this is a strong jacketed iron vessel with water in the jacket, provided with a safety valve, and heated by a large Bunsen burner. The cover is bolted on, and a thermometer is fixed in an opening of the cover so that the bulb of the thermometer is in the central chamber, while the tube is outside, and the temperature can thus be easily read. The time of heating occupies three or four hours. A thermometer with a solid stem, and graduated on the stem, should be used.

Indiarubber Stamps, Autograph.—To get a satisfactory mould for autograph stamps, great care in all the processes is essential. Coat a piece of flat metal plate evenly with melted beeswax to a depth of about $\frac{1}{16}$ in. Before this is quite hard, write slowly what is required; make the pencil or stylus penetrate to the metal, quite through the wax, from end to end of the autograph. Clear out any shavings or chips of wax that may clog the writing. Sift some plaster-of-Paris through fine muslin; dry the powder in an oven, making it hotter than the hand can comfortably bear. Grind it up with a pestle and mortar to remove all traces of lumps, then sift again. Replace in the mortar and add enough water to make a thick cream, using the pestle to get thorough mixture and to leave no unwetted powder. Pour the cream upon the wax autograph and pat it with a light stick, so as to force it well into the grooves of the writing. When the cream has set quite hard there should be a perfect facsimile. A similar procedure will obtain the true mould from the plaster facsimile (*see* previous paragraph).

Indiarubber Stamps, Ink Pads for.—A pad for inking rubber and other stamps will not be difficult to make. Take any shallow tin box with a cover or lid to it; if of circular form, so much the better. A tin canister, such as coffee and many other grocers' wares are sold in, can be made use of by drawing a circle round it 1 in. from the bottom, and very carefully following round the mark with an old pocket-knife blade resharpened for the occasion. To make a clean cut—and a clean cut it ought to be—saw out a circular piece of $\frac{3}{8}$-in. wood of the right size to go inside the tin fairly easily; push it down to the bottom, and then do the cutting. The original lid will do for the canister thus shortened to a shallow 1-in. circular tray. Cut from felt, or from old cloth—a discarded coat, for example—one or more circular pieces to fit inside the tray, and fill it three parts full. Saw out from $\frac{1}{4}$-in. wood a circular piece slightly smaller. Take a piece of calico twill—for a 3-in. tray let it be 6 in. square—spread it on a table and put the felt or cloth in its centre. On top put the $\frac{1}{4}$-in. wooden circle. Gather the edges of the twill up, and draw them tightly over the wooden circle towards its middle. Here confine them with a tin-tack or two, shearing off superfluous corners. Put the cushion thus made into the tin tray, pushing it down tight. When not in use keep the cover on. An even simpler plan is to cut from the lid of a cigar-box a piece of wood of the desired size. Upon this place several thicknesses of sheet-cotton cut to size. A stretch of fine woollen cloth and a top or surface of linen (a piece of an old handkerchief is excellent) are now put on. The two latter coats must be long enough to come well over the wood round the edges. Finally, tack on a binding of leather or tin.

If a lid of a tin box is handy, it is a good plan to make the pad to fit into it. A lasting rubber stamp ink pad that will continue to do duty for years without requiring re-saturation is made as follows: Glycerine 6 parts, water 1 part, gelatine 1 part, colouring matter 6 parts. Swell the gelatine with the water; then boil and add the other ingredients. For black colouring matter, use gelatine glue 1 part, lamp-black 3 parts, glycerine 10 parts, alcohol 1 part, water 2 parts, Venetian soap 1 part, salicylic acid $\frac{1}{5}$ part. For red or violet, substitute 2 parts aniline red or violet for the lampblack. With the hot liquid, saturate a cushion of cloth clippings packed in a tin box and covered at the top neatly with a smooth cloth surface. A self-inking stamp pad can be made by laying on a piece of wood (about 4 in. by 3 in. by $\frac{3}{8}$ in.) a piece of felt or flannel which has been thoroughly wetted with the ink, stretching over this a piece of fine cambric or linen, and tacking it at the back of the wood to keep it tight. The flannel or felt will hold a large supply of ink, which will last for a long time.

Indiarubber Stamps: Mounting.— The printing surface of large rubber stamps is very seldom level, owing to faulty mounting, and it is only after great trouble and careful manipulation that all the letters of a stamp are made to give an impression. This refers to ordinary rubber stamps (not pneumatic) mounted on brass plates or on wood. The following method of mounting will ensure a printing surface as level as it is possible to make it:—A piece of plate glass the size of the stamp, or a little larger, is procured, and one of its surfaces is rubbed over with a light coat of glue. Window glass may be used, but plate glass has a smoother surface, and is less liable to fracture. Place the rubber stamp, face downwards, on the glass, to which it will adhere. See that the letters are in the proper position, which is easily ascertained by looking through the glass from the other side. Now lay over the rubber a few sheets of blotting-paper and a heavy book, which will be sufficient to press all the letters into level contact with the glass and hold them there till the adhesive dries. Next the mount is taken in hand. If guttapercha cement is used, the mount has to be well heated, and is then heavily coated with the cement. The variety known as "cushion tyre cement" is excellent for this purpose. The book and blotting-paper are removed from the rubber stamp as soon as the adhesive is dry, and the mount, with its coat of hot cement, is gently pressed on to the back of the rubber, and left till the cement has cooled. The whole may now be immersed in water to soften the adhesive that holds the letters to the glass, and when the latter falls away, it will be found that the lettered surface is perfectly level.

Ink Stains, Removing

To remove ink stains from paper or parchment, make a solution of oxalic acid, and keep dabbing this upon the stains until they disappear. When clear of stain, press between clean white blotting-paper, moisten several times with water, and dry each time with clean blotting-paper or with a clean white cloth to remove the excess of oxalic acid. Place between blotting-paper, and put under equal pressure—a copying press, if available—allowing the parchment several days to dry. In the case of parchment, if the glazed surface is removed on the treated parts, make a solution of colourless gelatine, rub it on thin, and allow to dry. A solution of almost any acid will remove ink stains from paper, the best to use being either oxalic or citric acid. Chloride of lime is often recommended; this destroys the organic part of the ink, but leaves oxide of iron—a brown stain—on the fibre. Oxalic acid is poisonous, so that care must be taken with it. This method of treatment is also efficacious in removing iron stains from linen, etc. It removes the brown stains in about half an hour, used cold, but quicker if hot. Another method is to apply spirit of salts (hydrochloric acid) diluted with five or six times its bulk of water. Solutions of either oxalic, citric, or tartaric acids produce the same results; but in any case the acid must be washed off with clean water a minute or two after application. Experiment on odd pieces of parchment or paper before touching any valuable work, as some little skill is required. To remove ink stains from imitation ivory, wipe over

several times with 1 oz. oxalic acid dissolved in ½ pt. of hot water. Should this be of no avail, rub the surface with fine glasspaper till all marks are removed; then repolish with putty powder and oil, applied with felt or cloth; finish with dry powder and chamois leather. To remove ink or iron-mould stains from linen, moisten the latter by holding it in steam, then apply weak hydrochloric acid on a piece of stick. When the stain is dissolved out, wash the article well to remove all acid. To remove old ink stains from wood, rub the stains with muriatic acid, allowing the acid to remain for a few minutes; then sponge off with clean water. Spirit of salts may be used to remove old ink stains from wood; great care is required, especially if the stains are on a veneer. Another method is to apply spirit of nitre with a feather, and when the ink has disappeared to wash off with cold water. Another: use salt of lemons (binoxalate of potash) moistened with water. Another: put some powdered crystals of oxalic acid on the ink stains, moisten with hot water, and rub them in. The oxalic acid will dissolve most of the otherwise insoluble materials used in ink making, and the stain can be washed out with water. If this is not effective, try a solution of freshly made chloride of lime. Another: moisten the stains with stannous chloride. This will (presuming the ink be made with iron) deoxidise the iron. Salt of sorrel (oxalic acid) will then remove the iron residue. To remove from white paper stains made with violet ink, as used with a rubber stamp, soak the paper in methylated spirit until the ink is dissolved out, then place on clean blotting-paper and allow it to dry. Or touch the mark with dilute hydrochloric acid (one part of acid to three parts of water). When the mark has disappeared, remove the acid by moistening a piece of blotting-paper and placing it on the spot for a few minutes. Remove, and use several pieces of blotting-paper in this way; finally, dry between blotting-paper. One method of removing marking ink stains from linen is to moisten the linen by dipping it in, or applying by means of a small brush, a solution of 1 oz. of cyanide of potassium in 4 oz. of water. Great caution should be used in dealing with this solution, as it is highly poisonous. Another method is to apply dilute solutions of permanganate of potash and hydrochloric acid, followed by washing the linen in hyposulphite of soda and then in clean water. Another method: Steep the stained parts in a dilute solution of nitric acid or cyanide of potassium, using an earthenware bowl, not a metal one; afterwards wash well in water to remove any excess of these solutions, or the linen may be ruined. Caution must be exercised in the use of these solutions, as they are poisonous. The following method has been recommended:—First moisten the mark with tincture of iodine, to which is added some iodide of potassium; the mark will then turn very black, but, on brushing with a solution of cyanide of potassium, will be entirely removed. Then well rinse in clean water. By this process the fabric is not injured. Stains of indelible marking ink cannot always be successfully removed from clothing. Many of these inks have nitrate of silver as a basis; in this case a solution of hyposulphite of soda might help. Some other inks might possibly be bleached out with Javelle water and weak muriatic acid; this can be used only on white goods, as most dyes would be destroyed. Possibly, also, a solution of sulphurous acid might be of service.

Inks

The art of making a satisfactory ink can only be acquired by careful experiment, aided by judgment which has been developed by experience. Formulæ may help the experimenter by hints, but he must not expect to rival the popular brands at his first attempt. Nut galls and sulphate of iron are the principal ingredients of nine-tenths of the ink sold. The variable quality of the galls, especially in regard to the proportion of their tannin contents, is an obvious source of failure in the production of a fine colour, because the quantity of the iron salt ought to be measured not by the weight of the galls, but by that of the tannin they contain. Galls for ink-making should always be bought whole, as, if already bruised, it is impossible to estimate their value. The best galls are known as Aleppo; they have

a warty surface, are blue or green, and should be heavy and free from holes (showing that they have been collected before the insect has escaped). English galls are of no value. For use, the galls are broken up into a coarse powder in an iron or bell-metal mortar. Boiling or cold maceration, the period of infusion, and the ripeness of the ink are other conditions which need to be taken into account. The chemical action involved in the manufacture of ink depends on the action of iron salts on tannin and gallic acids. The proto salts of iron form with these a black precipitate, which becomes much more intense as the ferrous salt is oxidised into ferric. But no doubt too, the colour depends largely on the proportion of tannin and gallic acid thus combined. Galls contain a large quantity of tannin (from 25 per cent. to 70 per cent.) and only a very little gallic acid; but in infusion some of the tannin is converted by a process of fermentation into gallic acid, and it is likely that the best colour is obtained by precipitating the gallate at some particular point of proportion which cannot be indicated definitely. Ten parts of galls, 3·3 parts of sulphate of iron, 3·3 parts of gum, and 100 parts of water are the best average proportions for ink. In practice it has been found that a fortnight in summer, when the temperature ranges between 70° and 80°, is sufficiently long for the infusion to stand; but in the winter, when the temperature is considerably reduced, from three weeks to a month is necessary. Many different kinds of tanks are used, including galvanised iron, enamelled zinc, and earthenware. For beginning business, purchase three large red clay pans (bread pans), and see that the inside glazing is perfect, and that the covers fit well. Later on get a large wooden tray made similar in shape to an ordinary laundry tray, but having at one end a tap as near as possible to the bottom. A washing copper or a large iron boiling pot will also be required. Soft water is absolutely necessary to make the common ink, as sold by many makers retail at 1d. per bottle.

Black Ink.—(1) The common ink sold at oil shops at 1d. per gill can be made very cheaply. Boil in a copper 8 gal. of soft water, throw in 7 oz. of logwood extract, and put out the fire to stop the boiling. Add 1 oz. of bichromate of potash and 80 grains of prussiate of potash, and after straining, bottle it. (2) Bruise 6 oz. of best Aleppo galls, and boil in 6 pints of water for several hours, adding more water to supply the loss by evaporation. Strain whilst hot through calico into a clean vessel. Add 4 oz. of gum arabic, and boil till dissolved. Strain again whilst hot into a stone bottle, and add 4 oz. of sulphate of iron, previously dissolved in water. To preserve from going mouldy, add three drops of creosote for each pint of ink. The ink, to appear thoroughly black, must be kept for some time before using. (3) A black aniline ink is prepared by rubbing 60 gr. of aniline black with 60 drops of hydrochloric acid and 1½ oz. of alcohol. Dilute with 3 oz. of distilled water in which ½ oz. of gum has been dissolved. (4) Digest ¼ lb. of logwood chips for about twelve hours in 3 pt. of water and simmer gently till 1 qt. is left. When cold, decant and dissolve about 20 gr. of yellow chromate of potash in the solution, which must be well stirred the while. (5) For a cheap ink, dissolve a threepenny packet of Judson's dye in a small bottle with a little hot water, and add cold water according to the strength of colour desired. When required for use, pour a little into the ink-pot, and dilute with water as required. (6) To make black writing ink that will not be affected by water after writing, boil ½ oz. of lump borax with ½ pt. of clean water in a clean covered pot. When the borax has dissolved, add 1 oz. of bleached shellac and stir till dissolved. Add sufficient vegetable black that has been thoroughly mixed with water on a palette with a palette knife till it is free from lumps and forms a thick paste. (7) Shellac dissolved in methylated spirit and covered with aniline dye makes a bright waterproof ink, but this is rather difficult to use, except in cold weather, as the spirit evaporates and leaves the ink on the pen too thick to flow. It works all right if rapidly brushed on.

Blue Ink.—(1) Place in a tumbler a teaspoonful of soluble (or basic) Prussian blue, and add sufficient pure water to dissolve all the blue and make it of the proper consis-

tency for use as ink. (2) Allow 1 oz. of powdered indigo to stand in 7 oz. of oil of vitriol for forty-eight hours. Stir occasionally, and then add 8 oz. of water, thus forming sulphate of indigo. A permanent blue ink is made by dissolving 3 oz. or 4 oz. of this sulphate in 1 gal. of water. (3) Dissolve 3 parts of Prussian blue and 1 part of oxalic acid in 30 parts of water, and add 1 part of gum arabic. (4) Dissolve soluble Paris blue (cornflower blue) in alcohol. (5) Dissolve 2 oz. of Chinese blue in 1 qt. of water and add 1 oz. of oxalic acid, when the ink is at once ready for use. (6) Best logwood, 1¼ lb.; alum, 1 oz.; gum arabic, 1 oz.; sugar candy, ½ oz.; water, 10 pts. Boil for an hour, let it stand for two or three days, and strain through linen.

Blue-black Ink.—(1) The following recipe is said to have been the original formula for a popular product made by an eminent Scotch firm:—Blue Aleppo galls (free from insect perforation), 4½ oz.; bruised cloves, 1 dr.; cold water, 40 oz.; purified sulphate of iron, 1½ oz.; pure sulphuric acid (by measure), 35 minims; sulphate of indigo (to be used in the form of a rather thinnish paste, neutral, or nearly so), ¼ oz. Place the galls, when bruised, with the cloves in a 50-oz. bottle, pour upon them the water, and digest, with daily stirring, for a fortnight. Then filter through paper in another 50-oz. bottle. Get out, also, the refuse of the galls, and wring out of it the remaining liquor through a strong, clean linen or cotton cloth into the filter, in order that as little as possible be lost. Next put in the iron, dissolve completely, and filter through paper; then the acid, and agitate briskly; lastly, the indigo, and thoroughly mix by shaking. Pass the whole through paper. Filter out of one bottle into the other till the operation has been completed. On a large scale this fine ink may be made by percolation. No gum or sugar is required, but, when intended for copying, 5½-oz. galls is the quantity. (2) Digest together 7 oz. of bruised galls and ½ oz. of bruised cloves for about a fortnight in 5 wine-pints of water. Filter and add 3 oz. of sulphate of iron and 1 dr. of sulphuric acid. Well shake until the ingredients dissolve properly, and add 1 oz. of indigo paste, again filtering if desirable. (3) Dissolve in 12 oz. of water, 7 oz. of sulphate of iron and 20 drops of sulphuric acid; in a similar bulk of water dissolve about 1 oz. of tannin. Dissolve in 1 oz. of alcohol—spirit of wine—24 gr. of methyl blue. Add to the first solution the methyl and alcohol, then add the tannin water, and shake. This does not need to be kept to mature, as do the indigo inks. (4) Rub 6 parts of Prussian blue with 1 part of oxalic acid and a little water to a smooth paste and dilute with water. (5) Work together 15 parts of bruised galls, 5 parts of ferrous sulphate, 4 parts of iron filings, 200 parts of water, ½ part of indigo, and 3 parts of sulphuric acid. (6) A blue-black ink, but one which appears violet at the time of writing, is made by bruising elderberries, and setting them in a warm place for three days to ferment; strain, and add to each 6 pt. of juice, ½ oz. of sulphate of iron, and ½ oz. of acetic acid. (7) Stephens' blue-black ink is said to be made from galls 15 parts, sulphate of iron 5 parts, iron filings 4 parts, water 200 parts, indigo ½ part, and sulphuric acid 3 parts. The powdered galls should be boiled in the greater part of the water, and then filtered, the sulphate of iron should be dissolved in the remaining water, while the indigo must be dissolved in the sulphuric acid (which should be concentrated). The indigo solution should then be added to the sulphate of iron solution, and the iron filings added to neutralise the excess of acid. After a few days the sulphate of iron solution must be decanted and added to the solution of the galls; the ink will then be complete.

Boot and Shoemaker's Ink.—For making a quick-drying black ink for finishing boots: (1) 1 pt. of alcohol, 1½ oz. of tincture of iron, 1 oz. of extract of logwood, 1 oz. of pulverised nut galls, ½ pt. of soft water, and ½ oz. of sweet oil. The oil must be mixed with the alcohol prior to adding the water and other ingredients. (2) Soft water 5 gal.; bring it to a boil, and add 8 oz. of pulverised logwood extract, keeping it on the fire for three minutes only; then remove and stir in 2½ oz. of gum arabic, 1 oz. of bichromate of potash, and 80 gr. of prussiate of potash. (3) Soft water 1 gal., extract of logwood 1 oz.; boil till the extract is

dissolved, take from the fire, and add 2 oz. of copperas and ½ oz. each of bichromate of potash and gum arabic, all well powdered. (4) Heat together over a slow fire 16 oz. of white wax and 24 oz. of turps. When the wax has dissolved, mix in 8 oz. of ivory black and 1 oz. of powdered indigo. Take a little of this compound on a piece of cloth (not fluffy), and apply to the edge of the shoe. (5) In three quarts of water boil 4 oz. of logwood for an hour, adding from time to time a little boiling water to make up for loss by evaporation. Strain the liquor while hot, let it cool, and make up the quantity to five quarts by adding cold water. Then add 1 lb. of blue galls, coarsely bruised, 4 oz. of sulphate of iron, well crushed, ½ oz. of acetate of copper, previously mixed into a paste, 3 oz. of sugar candy, and 6 oz. of gum arabic. Use rain-water if possible. The addition of a teaspoonful of methylated spirit to half a pint of Harris's harness dye makes a fast-drying ink and gives a good polish when brushed. It must be well shaken before being used. (*See also* p. 73.)

Branding and Stencilling Ink.—(1) The following is the recipe for a perfect dead-black stencil ink which is insoluble in water: Dissolve 1 oz. of shellac in ½ pt. of methylated spirit of wine, filter it through a layer of chalk and then add lampblack. It will make the brush rather hard, but that can be softened by soaking in the ink before use. (2) Boil ½ lb. logwood chips for ten to fifteen minutes in 2 qt. of soft water; then add 1 drachm potassium bichromate, and boil up again for ten minutes. Add, when cold, some gum-water; stir, and shake well before using. (3) Rub equal parts of lampblack and fine clay into a paste in a solution of gum arabic, and add a little acetic acid, or common vinegar will do almost as well. This is very good for timber or packing-cases. (4) A very fine ink is made as follows: Take of shellac, gum arabic, and borax, each 1 oz. Dissolve in 12 oz. of soft water, and add sufficient Venetian red to bring the paste to desired stiffness. A violet colour may be got by adding Prussian blue (soluble). (5) A simple recipe is:—Incorporate lampblack with gold size, not too thin, and use sparingly. (6) The following is the composition of the ink used for marking sacks: Ordinary printer's ink, to which a little terebine has been added, may be used; or ordinary oil paint will answer the same purpose, if slightly thinned. Stencilling is performed by a dabbing motion of a stiff-haired brush, lightly charged with paint or ink, over the perforations in the stencil plate. (7) Special stencil ink may be prepared by incorporating any mineral colour (lampblack for black ink, or Venetian red for red ink) with gold size, and, perhaps, a little boiled oil. (8) Another method is to dissolve 1 oz. of shellac in ½ pt. of methylated spirit, adding to this any dry colour as required. Asphaltum, dissolved in naphtha or benzoline, may also be used. For cake stencil ink, grind lampblack and gum arabic down on a slab or in a mortar, make into a paste with water, and allow to dry. (9) An excellent solid stencil ink can be made as follows: First prepare a varnish of 2 oz. of gum arabic, ½ oz. of glucose, ¼ oz. of powdered borax, ¼ oz. of powdered alum, and 1 pt. of boiling water. Dissolve the gum in a quarter of the water; add the other ingredients, mixing thoroughly, while the mucilage is thick; but take care to maintain heat till all the water is assimilated, as on slightly cooling the mass would set irretrievably. This liquid is set aside till cold, strained through fine muslin, and ½ oz. of glycerine added. This is a stock liquor for any colour of stencilling cake. A suitable black with a rich, deep shade, cheap and compact, consists of 1 lb. of fine grey barytes, 10 oz. of whiting, 3 oz. of lampblack, and ½ oz. of American carbon black. The barytes goes to make up inertness and solidity. The glycerine in the liquor prevents mildew and gives elasticity. This may be varied slightly at discretion. When a good stiff dough has been formed, it should be spread out in shallow tins, and partly dried at about 80° F., then divided into squares with a baker's biscuit cutter, and thoroughly dried. (10) For a red stencil ink for marking boxes, etc., get 3 lb. of pipeclay from the pipe-maker's (that sold at shops is half whiting), and crush or scrape into a fine powder. Make a stiff mixture of Indian red in water, scrape a few shreds of soap, then add these and mix well. Now gradually add the

pipeclay until the mixture is of the consistency of putty. Then make it into cakes, and dry with gentle heat for use.

Brown Ink.—Brown ink is simply a strong decoction of catechu (tannin), the shade varied by a weak solution of bichromate of potash, carefully handled.

Copper-plate Ink.—The inks used by copper-plate printers are very similar in composition to those used by letterpress printers, but the "varnish" is usually thinner, and instead of lampblack other pigments are used. Copper-plate varnish, or, as it is sometimes called, "burnt oil," is prepared in three strengths—thin, medium, and strong. In the old method of manufacture, which was very crude and dangerous, the raw linseed or nut oil was heated in a pot, set fire to, and allowed to burn five minutes; well stirred, and then removed from the fire, the lid being put on to extinguish the flame. Several pieces of stale bread were next successively introduced, stirred round, and then removed before they became charred. The object of this treatment is not apparent, but it is still believed in. It is said to remove the "grease." Sometimes peeled onions were used instead. After this treatment the oil was either allowed to cool down or again inflamed until the required strength was obtained, the strong varnish being about as thick as treacle. In modern works a different plan is pursued. The linseed or nut oil is first heated with nitric acid or magnesia to remove the "grease," and then heated slowly to 180° C. in a pan. Finely powdered potassium bichromate is now added, and the heat raised to 300° C. When the frothing has ceased, "pure" blue (Prussian blue) is added, the heat being maintained half an hour for strong varnish; for the medium, the heat is 300°–305° for five minutes; and for the thin, 275° for fifteen to thirty minutes. By another method, oxygen may be passed over the heated oil instead of using the bichromate. In whatever method prepared, the oil is allowed to settle a month. The blacks used in colouring copper-plate inks are Frankfort black, produced by calcining the refuse stalks, skins, etc., from wine manufacture; fish black, made from oyster shells, etc.; cork black, and German black, made from the above mixed with bone black. These blacks are prepared by heating the materials in specially designed retorts. They are ground with water and moulded into drops. The ink is often made on the small scale with a muller and stone, the colour being moistened with thin varnish, ground up with it, and then let down with the strong varnish, blue being added if required. On the large scale the materials are heated together, and then ground in granite or iron roller mills. In compounding inks, mixtures of the above blacks are used because each one has a shade of its own. A very good ink is made from thin nut-oil varnish, 1,000 parts; strong varnish, 200; Carnauba wax, 25; paraffin, 35; resin soap, 25; Paris violet, ½; pure blue, 40; cork black, 100; blood black, 50; Frankfort black, 200; and bone black, 150 parts. Other proportions are, approximately, 10 lb. oxidised linseed oil, 4 lb. resin, 2 lb. yellow soap, and 5 lb. lampblack. An ink may be made direct by grinding together 9 oz. of balsam of copaiba, 3 oz. lampblack, 1½ oz. Prussian blue, ¾ oz. Indian red, and 3 oz. of yellow soap.

Copying Inks.—(1) Copying inks may be made by adding a small quantity of alum to an extract of logwood. To this is added table salt or sugar and glycerine. The inks so obtained are purple when first used, and darken gradually on the paper. The copies taken from them darken still more slowly. (2) An ink which will yield one or two copies by hand pressure may be made by mixing, say, 1 pt. of glycerine in 3 pt. of jet-black writing ink. (3) The following is a recipe that has been recommended:—Place 2 dr. of crystallised carbonate of soda and 1 oz. of extract of logwood in a porcelain receiver with 8 oz. of distilled water. Heat this until the solution reaches a deep red colour and everything is quite dissolved. Then remove it from the fire and stir in 1 oz. of glycerine, 15 gr. of neutral chromate of potash dissolved in a little water, and 2 dr. of finely pulverised gum arabic, previously dissolved in a little hot water. (4) Take 4 gal. of soft water (preferably rain-water),

and add gum arabic, clean copperas, and brown sugar, using of each ½ lb. (not more), and 1 lb. of powdered nutgalls. Allow this to stand for two weeks, shaking occasionally, then strain. This ink will not fade on exposure to the atmosphere. (5) A simple method of making copying ink is to evaporate 1 oz. of ordinary ink to a quarter of its bulk, and dissolve in it 20 gr. of powdered sugar. (6) Boil together ½ lb. logwood extract, 2 oz. of alum, 4 dr. sulphate of copper, 4 dr. sulphate of iron, 1 oz. of sugar, and 4 pints of water, and filter through flannel. Add a solution of 4 dr. of neutral chromate of potash in 4 oz. of water, and a solution of 2 oz. of chemic blue in 2 oz. of glycerine. (7) For red copying ink, dissolve 5 parts of logwood extract in 150 parts of distilled water without the aid of heat; add ⅖ part of chromate of potassium, and set aside for twenty-four hours; then add a solution of ⅖ part oxalic acid, 4 parts oxalate of ammonium, and 8 parts of sulphate of aluminium in 40 parts of distilled water, and again set aside for twenty-four hours. Boil in a copper vessel, and add 10 parts of vinegar. In a fortnight's time, decant and bottle. (8) An "express" copying ink—that is, an ink capable of giving copies by slight pressure without moistening—is composed of 20 parts of ordinary ink, 12 parts of glycerine, 4 parts of honey, 4 parts of rock candy, 1 part of treacle, and 2 parts of alcohol.

Drawing Ink.—Good drawing inks are prepared from Indian and Chinese inks (*see* "Indian Ink," p. 309). Waterproof drawing ink can be made by boiling together 2 parts of shellac, 1 part of borax, and 12 parts of water; when solution is complete the liquid is filtered. About 1 part of gas black is moistened thoroughly with this liquid, and passed several times (till quite smooth) through a cone paint mill; it is then thinned down with more of the liquid till of proper consistency for writing with. This is similar to the American Indian ink used for process work. For making red and blue waterproof drawing inks, prepare a fluid by boiling 4 oz. of shellac and 1 oz. of borax in 36 oz. of water; strain. Grind the colours in this liquid. For red, use vermilionette or Indian red; and for blue, use indigo. Sufficient colour should be placed in a mortar, a little of the liquid added, and the two thoroughly ground together; more of the liquid may then be added until the mixture is of the proper consistency for working. Transparent coloured inks may be made by dissolving aniline dyes in the liquid. These dyes give a great range of fine colours.

Dry Ink for Traveller's Use.—Dry ink in the form of powder, pellets, cakes and tablets is in use—and was so even more before the advent of the fountain pen—because of the inconvenience of carrying liquid ink from place to place. Following are some recipes for ink powders:—(1) To a mixture of 4 oz. of powdered galls, 1 oz. of powdered sulphate of iron, 1 oz. of powdered gum arabic, ½ oz. of powdered white sugar, and 1 dr. of powdered cloves, add 1 qt. of water, and macerate for an hour or two. (2) Powder and mix together 3 lb. of Aleppo galls, 1 lb. of copperas, ½ lb. of gum arabic, and ¼ lb. of white sugar. For use, dissolve 2 oz. of the powder in 1 pt. of boiling water. (3) Pulverise and mix thoroughly 50 parts of logwood extract and 1 part of bichromate of potash. Add 6½ parts of indigo blue. (4) Pulverise and mix together 16 oz. of nutgalls, 7 oz. of copperas, and 7 oz. of gum arabic. Add two or three powdered cloves to each pound of powder. (5) A simple method of preparing ink powder is to reduce soluble nigrosin to an impalpable powder by grinding. (6) Ink paper, which serves the same purpose as the powder, is made by saturating sheets of paper with aniline black, and then pressing them into a compact form. For use, a little piece is torn off and steeped in a small quantity of water. (7) Ink powders can be made into pellets, cakes, or tablets by moistening with gum-water, shaping and drying.

Glass, Ink for.—(1) Ink for writing upon glass or porcelain is made by dissolving 10 parts of bleached shellac and 5 parts of Venetian turpentine in 15 parts of oil of turpentine—the containing vessel being immersed in warm water. After the solution is effected, 5 parts of lampblack are incorporated. (2) A solution of fluoride of

ammonium can be used; it must be kept in guttapercha bottles. (3) Asphalt dissolved in turpentine. (4) Amber varnish containing a sufficient quantity of lamp-black. (5) Dissolve 20 grammes of brown resin varnish in 150 c.c. of cold alcohol, and then add, drop by drop, 35 grammes of borax dissolved in 250 c.c. of distilled water. Tint the ink by adding methyl blue. (*See also* "Writing on Glass," p. 259.)

Gold Ink.—The best gold ink may be made by employing genuine gold leaf, but for common work Dutch metal will have to be used. Grind with a little honey on a sheet of glass until it is pulverised, then wash it into a beaker with distilled water. Boil with potash, decant the liquid, add water and again decant, then dry the powder. An ordinary ink may be made from this by mixing it with a solution consisting of 1 part of gum arabic in 4 parts of distilled water, to which has been added 1 part of potash water-glass. This ink adheres well, but water would remove it to some extent. An indelible ink can be made from the gold powder by mixing it with a strong solution of bleached shellac in alcohol.

Green Ink.—The aniline green known as ethyl green, fast green, or malachite green is suitable for a green ink; it may be dissolved in the proportion of 1 or 2 parts in 100 parts of water. Gum is usually added to thicken inks, otherwise they run off the pen far too quickly and form blots. The usual recipes for green inks contain salts of copper (such as verdigris), which set up corrosive action when used with a steel pen; the colours also are much too weak to produce satisfactory inks. A few drops of carbolic acid should be added as a preservative.

Hektograph Ink.—(1) A black ink for hektograph copying can be made by dissolving 1 part of nigrosine or water-soluble black in 7 parts of water and 1 part of alcohol. (2) An experimentalist says that a good black graph ink is difficult to obtain. Those who desire a thoroughly satisfactory ink may safely rely upon the following:—Place ½ lb. of powdered nutgalls in ½ gal. (4 pt.) of cold water; shake frequently for three days, then add 3½ oz. of sulphate of iron, 2 oz. of gum arabic, and 3 drops of creosote. Keep it well corked for a month; agitate it once every day for three weeks, allow one week for settling and clearing, and, lastly, strain through fine calico. This yields a splendid ink for ordinary writing purposes, drying a deep, permanent black. It is totally impervious to water, and must, therefore, undergo a special treatment to render it adaptable. Pour 12 oz. into a jar, which must be placed in a saucepan half filled with water and permitted to simmer down to 2 oz. When cold, add a few drops of methylated spirit; make an admixture of ⅛ oz. of soluble indigo and sufficient dilute acetic acid to form a semi-fluid paste; put it with the first preparation, then pour in ½ oz. of methylated spirit, which entirely changes the appearance of the ink, making it lumpy, thick, and apparently useless. Add six drops of liquid ammonia, which has no visible effect. Slowly infuse dilute acetic acid until the ink is restored to a liquid state—about ¼ oz. will convert it. Lastly, add four or five drops of glycerine and stir all well together. Pour into a bottle and keep well corked. For this ink a transfer paper is necessary. Brush a mixture of 1 part crystal varnish and 2 parts spirit of turpentine over white paper, and, when dry, write upon it, and continue as explained on p. 292. Although not essential, this prepared paper may be advantageously used with the commercial graph inks. (3) For the ordinary coloured hektograph ink, dissolve ½ oz. methyl or aniline violet in 5 oz. of strong alcohol, place the solution in a covered earthenware vessel for about four hours, add 36 oz. of distilled water, and heat gently over a fire until the odour of alcohol is no longer perceptible. The ink should be taken out, allowed to cool, and put in a well-stoppered bottle; then when cold it is ready for use. (4) A simple multigraph ink may also be prepared by mixing well together blue, red, or violet aniline 20 parts, distilled water 100 parts, and acetic acid 50 parts; keep this in a well-stoppered bottle. (5) Dissolve 1 part of methyl violet in 5 parts of water and 1 part of spirit of wine, and when perfectly dissolved, add 4 parts of glycerine.

Indelible Ink.—An indelible ink, the use of which in writing the public records of the State of Massachusetts is enforced by a law passed some years ago, is made by mixing together 23·4 parts (by weight) of pure, dry tannic acid, 7·7 parts of crystal gallic acid, 30 parts of ferrous sulphate, 10 parts of gum arabic, 25 parts of diluted hydrochloric acid, 1 part of carbolic acid, and 902·9 parts of water. The Secretary of the Commonwealth decided on this ink after samples of many inks had been tested. Writing executed with the accepted ink had to withstand the action of the sun's rays behind a sheet of glass for three months; but a more severe test than this was adopted afterwards, as, in addition to the foregoing, the writing had to be exposed for six months, without protection, to the action of the weather. The paper on which the writing had been executed was, before the tests, to be soaked in water, then in alcohol, and lastly in a mixture of the two, to determine whether the colour of the ink would fade or the ink itself spread. The ink whose composition is given above is said to have come out of these severe tests with every satisfaction.

Indian Ink.—The true Indian ink is made in China by grinding lampblack with a solution of gelatine or parchment glue, but many samples of ink are made by mixing lampblack with a strong solution of gum arabic. For drawing on paper, especially where washes of colour have to be put on over the lines, liquid drawing inks such as Higgins' and Wolff's are very useful, as they give a good black line and do not wash up or run when the colour is washed over the lines. But for tracing, both on linen and paper, Indian ink rubbed up from the solid stick is the best. To prepare this, pour a few drops of clean water into a smooth 4-in. or 6-in. colour saucer, and rub the stick of ink with a circular motion and moderate pressure for from five to ten minutes or more, according to the quantity of water. To judge when the ink is thick enough for use, blow on the surface, and the consistency can be estimated by the quickness or slowness with which the disturbed surface returns to a level. If too thin, a grey line will result, and if too thick, the ink will not flow freely from the pen. Some draughtsmen use a small marble slab for rubbing up the ink, from which it is scraped into the saucer and a little more water added to bring it to a working consistency. For working on tracing linen, in addition to dusting the surface with whiting to remove some of the grease, it is often necessary to add a little prepared ox gall, or to rub up a little soap with the ink to make it flow freely. This must not be used on drawing paper or tracing paper unless the surface is greasy. A little bichromate of potash rubbed up with the ink will prevent running when a wash of colour is put over the lines, but this must be used sparingly, a piece the size of a pin's head being sufficient for each saucer of ink. If too much is used, it will run and make a yellow smear on each side of the lines. When the ink is prepared, it must be kept covered up with another saucer or a lid, which should only be lifted to fill the pen, or dust will get into the liquid and clog the pen. Ink that has been rubbed up for a day or so may have a little water added, and be rubbed up again for tracing purposes. For a drawing of any importance, it is better to wash out the saucer and prepare fresh ink. The addition of a few drops of strong solution of alum will help to fix the ink. Another method is to boil 4 parts of shellac with 1 part of borax and 10 parts of water, and mix a little of this with the Indian ink solution. It would be better, however, to prepare the liquid ink by rubbing the above solution with a cake of dry ink until a good black fluid is obtained.

Ink Paper (*see* Dry Ink, p. 307).

Levant Ink.—To make Levant ink, as used in the leather trade, mix by heating 2 oz. of logwood extract, 1½ oz. of sulphate of iron, and 4 oz. of gall nuts (crushed) in 1 gal. of water.

Luminous Ink.—Luminous ink may be made by carefully grinding together luminous calcium sulphide and very thin gum water. Expose the writing to bright daylight or sunlight each day.

Marking Ink.—The only really reliable marking inks, apart from stamping inks,

are those that contain compounds of silver, gold, or platinum. Silver inks are indelible as long as the fabric lasts, but they become paler as the fabric wears away. Chloride of lime or Eau-de-Javelle bleaches silver marking ink, the action being to convert the black metallic silver into white silver chloride. The following recipes are for silver inks :—(1) Nitrate of silver 17 parts, ammonia 42 parts, carbonate of soda 22 parts, gum 20 parts, sulphate of copper 33 parts, distilled water 85 parts. Dissolve the carbonate of soda in 25 parts of water, the gum in 50 parts of water, and the nitrate of silver in 10 parts of water. To the solution of nitrate of silver add the ammonia and shake thoroughly; mix the solutions of gum and carbonate of soda and add to the silver solution; finally add the sulphate of copper and shake till dissolved. (2) Dissolve 2 dr. of nitrate of silver in 1½ oz. of water, and add strong ammonia gradually until the precipitate which first forms is just redissolved, make up to 2 oz. with water, and colour with a little indigo extract, sap green, or any suitable aniline colour. It is usual to press a hot iron upon the marking so that the ink may decompose and the silver be reduced. (3) The following is an aniline ink :—Triturate 1¾ parts of aniline black in 4 parts of strong hydrochloric acid and 42 parts of strong alcohol. When solution is complete, add a solution of 2½ parts of gum arabic in 170 parts of water. The aniline black is the true aniline black insoluble in water, not the nigrosines which are soluble. (4) When making marking ink from cashew nuts, the nuts are ground coarsely and then treated with petroleum spirit agitated from time to time and filtered. The petroleum spirit is allowed to evaporate spontaneously by letting the liquid remain in a shallow dish in contact with the air. The syrupy extract thus formed gives on linen a brown mark, which becomes black by treatment with ammonia or lime water. (5) Add caustic alkali to a saturated solution of cuprous chloride until no further precipitate forms.; allow to settle, draw off the liquid, and dissolve the oxide in the smallest quantity of ammonia that will absorb it. It may be mixed with about 6 per cent. of gum dextrine, when it will be ready for use.

Preserving Writing Ink.—The best preventive of mouldiness is carbolic acid, about half an ounce to the gallon. Metal inkstands are likely to decompose most inks. The formation of mould on inks is prevented by the addition of ½ oz. of crushed cloves to every pound of galls; or equally by the addition to the prepared ink of a minute pinch of mercuric oxide (about 5 gr. to the pint). Nitro-benzene, boracic acid, and creosote are also used for the same purpose.

Printing Ink.—Printing ink is not usually made satisfactorily in the absence of big plant, but below are given some simple instructions easily followed. Into a 5-gal. iron pot pour 6 qt. of old linseed oil, and heat gradually over a fire to boiling point. As soon as the vapours that arise from the surface will catch fire when a light is applied, remove the pot from the fire and allow the oil to burn for a time; smother the flame by placing the lid over the pot. If the oil has thickened sufficiently, it will draw out into threads ½ in. long when dropped on a cold surface. Should it not be thick enough, relight it, and allow it to burn down. If the oil is all right, stir till the frothing ceases, and put in gradually 6 lb. of crumbled amber resin, and keep stirring till all is melted. Then stir in 1¾ lb. of sliced curd soap, and when the frothing has ceased, place it on the fire and bring to boiling point, stirring well all the time. This is printers' varnish. Varnish is best made out of doors; it smells unpleasant in boiling, and there is less risk of fire in the open. To make brown ink, add varnish to a powdered mixture of 2 oz. of burnt umber and 1 oz. of rose pink, and grind till smooth with a muller. Indian red and Venetian red, toned with a very little lampblack, also give browns. A fine black ink may be made with 9 oz. of balsam of copaiba, 3 oz. of lampblack, 1½ oz. of indigo or Prussian blue, or ¾ oz. of each, ¾ oz. of Indian red, and 3 oz. of dry turpentine soap. These are to be ground with the varnish till quite smooth with pestle and mortar, or a muller and slab. For black varnish ink, 5 oz. of Prussian blue or indigo or 2½ oz. of each, 4 lb. of mineral lamp-

black, and $3\frac{1}{2}$ lb. of good lampblack, are mixed with warm varnish, and the whole is well ground on a slab with a muller.

Red Ink.—(1) To make bright red ink, over 8 oz. of bruised cochineal pour 1 gal. of boiling water, and let it stand. Now boil 8 oz. of Brazil wood in $\frac{1}{2}$ gal. of soft water for half an hour, and in two days' time mix both together. Dissolve 2 oz. gum arabic in 1 qt. water, and when cold add one solution to the other and stir well. Cork the mixture up, and in seven days strain through muslin and bottle. (2) Pour 2 parts of 90 per cent. alcohol over $\frac{2}{5}$ part of finely rubbed fuchsine, and dissolve by gently heating. Dissolve 1 part of gum arabic in 20 parts of water, boil, and then, whilst stirring, add the fuchsine solution in a thin jet. (3) Dissolve 30 gr. of No. 40 carmine in 1 dr. of ammonia; add 6 gr. of gum acacia and sufficient water to make 1 oz. The tint is regulated by the amount of water added. (4) Grind 1 part carmine with 15 parts acetate of ammonia and 15 parts water. This is allowed to stand for some time, strained, and then thickened with a few drops of dissolved white sugar. (5) Dissolve $\frac{1}{2}$ dr. of powdered drop lake and 18 gr. of powdered gum arabic in 3 oz. of ammonia water. (6) Dissolve $\frac{1}{2}$ oz. of aniline red in 5 oz. of strong alcohol; let it stand in a covered vessel for about three hours, then add 35 oz. of distilled water. Heat gently for some hours until the odour of alcohol is no longer perceptible. Add to the liquor 8 oz. of distilled water in which 2 oz. of gum has been previously dissolved. (7) Aniline red, 20 parts; gluten or gum, 100 parts; water, 1,000 parts; and acetic acid, 100 parts. The process is practically the same as with (6). (8) Dissolve 1 oz. of aniline crimson in 1 gal. of water. (9) For red cochineal ink, rub together powdered cochineal, $\frac{1}{2}$ oz.; carbonate of soda, 1 oz.; distilled water, 13 oz. Mix these in a large mortar capable of holding 3 pt. or 4 pt., and stir frequently during two days; then add cream of tartar, $\frac{3}{4}$ oz.; alum, $\frac{3}{8}$ oz. Warm gently, and stir until all the carbonic acid has passed away. Add gum arabic, $\frac{3}{4}$ oz.; alcohol, $\frac{1}{2}$ oz. Filter, and make up the solution to 15 oz. with distilled water. The ink should be at once bottled, and kept well corked. (10) Rub 1 part of carmine with $12\frac{1}{2}$ parts of liquid water-glass. Dilute with $112\frac{1}{2}$ parts of rain-water, allow to stand for a few days, and pour off. (11) Buchner's carmine ink is made by dissolving together 12 gr. of pure carmine, or $\frac{1}{2}$ dr. powdered drop lake, and 3 oz. of aqua ammonia. Add 20 gr. powdered gum.

Ruling Ink.—The ink used for machine ruling is made from various pigments, combined with fresh ox-gall and alcohol—a tablespoonful of gall to a quart of alcohol being usually sufficient; but if the paper to be ruled is found to be extra hard, or unusually "greasy," more ox-gall should be added. See that the flannels over the pens are kept perfectly clean. They should be washed frequently—about every other day—with soap and warm water. It is important to keep all the nibs at a uniform angle, to avoid "beading"—that is, a tendency of the ink to make beads or blobs instead of fine straight lines. Cleanliness and careful adjustment of the pens are as important as the condition of the ink. To make red ruling ink, boil $\frac{1}{2}$ lb. of Brazil wood shavings in 2 qt. of dilute vinegar, then dissolve in it 1 oz. of gum arabic, 1 oz. of sugar, and 1 oz. of alum. Another red ink may be prepared by mixing together 1 oz. of powdered cochineal, 2 oz. of carbonate of soda, and 26 oz. of water; allow this to stand for two or three days, then add $1\frac{1}{2}$ oz. of cream of tartar and $1\frac{1}{2}$ oz. of alum, and warm the mixture gently; $1\frac{1}{2}$ oz. of gum arabic and $1\frac{1}{2}$ oz. of alcohol should then be added, the mixture filtered, and made up to 15 oz. Red inks are now often made with eosine, a coal-tar colour; this may be dissolved in alcohol, water added to dilute it, and a little gum arabic dissolved in it to thicken it. A blue ruling ink can be made by dissolving 1 oz. of sulphate of indigo in 2 qt. of water, and adding 1 oz. of gum arabic and 1 oz. of sugar.

Stamp Ink.—To prepare coloured inks for rubber stamps, dissolve aniline of the desired colour in hot glycerine until the solution is of the required tint, then strain. A beautiful blue ink may be made by

substituting soluble Prussian blue for aniline. A superior stamp ink may be made by dissolving 200 gr. of violet aniline in 2 oz. of distilled boiling water, then adding one teaspoonful of glycerine and half a teaspoonful of common treacle. Indelible black ink for rubber stamps can be made as follows:—(*a*) Asphaltum, 1 part; oil of turpentine, 4 parts. Dissolve together, and temper with printers' ink. (*b*) Boiled linseed oil, 16 parts; lampblack, 6 parts; ferric chloride, from 2 to 5 parts. Dilute with printers' varnish. (*c*) Aniline black crystals, 1 part; alcohol, 30 parts; glycerine, 30 parts. Add the glycerine after dissolving the crystals in the alcohol. For a white ink for use with rubber stamps, grind together very carefully 2 oz. of zinc white with 1 oz. of glycerine; when the mass is homogeneous, add 1 oz. of methylated spirit.

Sympathetic or Invisible Inks.—Sympathetic or invisible inks were at one time very popular, and remarkable effects have been produced by those who have given a little study to the subject. A landscape or a few figures sketched with sympathetic inks may be made to show a variety of changes, both pleasing and startling. These inks, however, can not only be made to furnish amusement for a leisure hour, but will be found of real value when communicating with friends on postcards, etc. The appended recipes for these inks will give very good results. The simpler recipes, such as writing with cow's milk and holding the paper close to the fire, are sure to be successful at the first trial; but the complicated recipes, which are more in the nature of chemical experiments, must be carried out with the care that chemical experiments demand, or the results will not be successful. A clean pen should always be used, and a quill pen for preference, because chemical action is at once set up when iron is brought into contact with acids. Writing with a colourless fluid will be somewhat awkward at first, but a little practice will soon enable the writer to distinguish the marks of his pen. All invisible inks will show on glazed paper, therefore unglazed paper should be used. The recipes that follow are stated as briefly as possible. In all cases the writing should be carefully done, allowed to dry, and then developed in the manner indicated. (1) A weak solution of sulphuric acid (oil of vitriol) will be invisible on paper when dry, but when the paper is held before the fire, the writing will char and appear of a brownish-black colour. (2) A colourless solution of sulphate of iron (green copperas), or sulphate of copper (blue vitriol), is invisible when dry, but becomes visible (the iron blue and the copper brown) when dipped in a solution of ferrocyanide of potassium (yellow prussiate of potash), and the latter will appear of a light-blue colour when exposed to the vapour of ammonia. (3) A colourless solution of nitrate of lead is invisible on paper when dry, but turns a deep black when exposed to the vapour of ammonium sulphide. (4) A thin solution of arrowroot or cornflour is invisible when dry, but becomes blue when held for a few seconds in the vapour of iodine solution. (Put a little iodine in a basin and add warm water.) (5) A saturated solution of alum and lemon juice may be rendered visible by dipping the paper in water. (6) Writing done with cow's milk becomes of a reddish colour when the paper is warmed at the fire or ironed with a hot flat iron. (7) The juice of a Spanish onion or turnip turns brown when the paper is heated. (8) Rice-water is invisible when dry, but appears of a blue colour by the application of iodine. Rice-water was frequently used as a secret ink during the Indian Mutiny. (9) Nitrate of copper in weak solution becomes red by heating. (10) Chloride of copper in very dilute solution (equal parts of blue vitriol and sal-ammoniac dissolved in water) is invisible until heated. (11) A weak solution containing nitrate of nickel and chloride of nickel becomes green (when impure) or yellow (when pure) by heating. (12) Solution of chloride of cobalt (cobalt 25 gr., water 1 oz.) is pink when damp, invisible when thoroughly dry, and green when heated; when often heated or made very hot, the writing becomes a brownish-red. (13) Solution of acetate of cobalt containing nickel or iron becomes green when heated, but when pure and free from

these metals it becomes blue. (14) Bromide of copper (1 part of bromide of potassium, 1 part of blue vitriol, 8 parts of water; discharge the colour of the blue vitriol by adding 1 part of alcohol) becomes visible when very slightly heated, and the colour disappears on cooling. (15) Solid paraffin dissolved in benzol becomes invisible when the solvent has evaporated, but is rendered visible by dusting with lampblack or powdered graphite, or holding in the smoke of a candle flame. (16) Iodide of potash and starch (boil the starch and add a small quantity of iodide of potassium in solution) becomes blue when nitrous acid is present in the atmosphere, or in the presence of ozone. (17) A diluted acid solution of ferric chloride becomes red when exposed to sulphocyanic vapours, and the colour disappears when exposed to ammonia vapour. Alternate treatments as above cause the appearance and disappearance of the writing.

Ticket Ink.—(1) Stephens's ebony stain is a smart ticket ink, lasting for some years. It dries quickly,-and yields a semi-lustrous surface, while for brilliance of colour it cannot be excelled. It has been used for the writing of placards for outside work with every satisfaction. (2) In a suitable vessel over a fire dissolve 6 oz. of pale or white gum lac with 11 oz. of water and 2 oz. of liquid ammonia. This is the medium, which may be coloured by adding lampblack, if black is required; for a brilliant red, add ammoniacal solution of carmine; for blue, add aqueous solution of fuchsine; and for green, add aniline green. The colouring matter should be added while the lac is boiling. Another medium may be prepared by mixing together 1 oz. of pale gold-size, 1 oz. of pale terebine, 6 oz. of copal varnish, and 2 oz. of turpentine. With this medium any paste, paint, or dry pigment may be mixed for colouring matter. The preparation works freely, and dries quickly with a brilliant gloss. (3) For small stiff tickets, write with ordinary ink, and varnish with spirit varnish applied with a large soft brush very carefully. When the varnish dries, the surface will be impermeable to wet. (4) Gelatine melted in hot water, and then having enough vermilion added to produce the required shade of red. When wanted, the gelatine ink should be stood in hot water and melted, the colour if sunk to the bottom being stirred. (5) Either gelatine or size mixed with vermilion melted in hot water; bichromate of potash, dissolved in as little hot water as is necessary, is added to small quantities of this ink a few minutes before it is used. The ink must then be used at once, in a room dimly lighted. When tickets written with this ink are exposed to strong sunlight for an hour or more, the ink becomes non-absorptive of water, and remains fast against rain, etc. An objection to this ink is that it cannot be dissolved again by water after light has fixed it. (6) For small tickets, bleached shellac dissolved in spirit of wine and coloured with any of Judson's dyes will make a moisture-proof writing material. This is expensive when large quantities are used. It also evaporates from the bottle very quickly. (7) Get some white hard spirit varnish and put it in a soundly corked bottle. Dissolve in a little spirit of wine any of Judson's aniline colours, sold in penny packets. Add the coloured spirit to the required quantity of varnish, and use quickly in a cold room.

Tinware, Ink for.—An ink for marking tinware is made by working up asphalt or black varnish with turpentine. It must be kept in a corked or stoppered bottle, and is shaken thoroughly just before use. On withdrawing the cork, enough of the marking fluid adheres to it, and the pen can be filled from the cork. The ink is removed by rubbing with a cloth dipped in coal-tar oil or turpentine. Another suitable ink is made by reducing shellac varnish with alcohol, and adding finest lampblack. This forms a dead black ink insoluble in water, though it can be removed with alcohol.

Transfer Ink.—For transfer ink to be used for tracing patterns on paper and cloth dissolve in soft water ½ oz. of tragacanth, strain, and add 1 oz. of fine clear glue and 1 oz. of gamboge. Then take 4 oz. of French chalk and 4 oz. of starch, grind and incorporate, and thin with water.

For black fabrics with rough surface the following will be found both cheap and useful. Boil some parchment clippings in water, and add to this sufficient pipe-clay in powder to give a body. Use the size warm, and transfer by using a hot iron. The following are recipes for litho transfer ink:—(1) White soap 10 parts, white wax 10 parts, mutton suet 3 parts, shellac 5 parts, mastic 5 parts, and lampblack 3 to 3½ parts. (2) Mastic in tears 8 parts, shellac 12 parts, Venice turps 1 part, wax 16 parts, tallow 6 parts, tallow soap 6 parts, and lampblack 4 parts. Melt the mastic, shellac, and turps together, then add the suet or tallow and wax; when these are melted, add the soap (cut into thin shavings), slowly mix, then add the lampblack and stir thoroughly. Pour the mass into moulds or on to an iron plate to cool. Wrap the cakes or sticks in tinfoil.

Typewriter Ink.—Typewriter inks are of two kinds, copying and non-copying. The former are made with glycerine, and the latter with oils, and they differ in behaviour when treated with water. Copying inks dissolve readily, non-copying inks being practically unaffected. The following are recipes for copying inks:—(1) Methyl violet ¼ oz., alcohol 2 oz., glycerine 4 oz. (2) Methyl violet 1 part, glycerine 6 parts, soft soap 3 parts; warm together till dissolved. Glycerine alone is too sticky, and does not sink into the ribbon sufficiently; it has to be applied sparingly. A bronze colour shows that there is too much methyl violet in the mixture; dilution with alcohol will remove this tint and bring out the violet, besides helping considerably to dissolve the dye, and rendering it more workable. The ribbon can be run through burnishing rollers, which can be obtained from dealers in photographic appliances. In some machines the type is inked by means of a saturated pad or roll, instead of with a ribbon; but practically the same kind of ink—aniline and glycerine—is employed. Non-copying inks are mostly made with castor oil, oil of cassia, and oleic acid, sometimes with the addition of carbolic acid, and the colours may be aniline soluble in oil, or such dyes as are soluble in oleic acid or carbolic acid.

Violet Ink.—(1) A violet writing ink may be prepared by dissolving ½ oz. of methyl violet in 5 oz. of rectified spirit; when solution is complete, add 35 oz. of distilled water and warm on the water bath till the odour of alcohol is no longer perceptible, then make up to the original volume with distilled water. Take 2 oz. of gum arabic and dissolve in 8 oz. of distilled water; mix this with the dye solution, and add a few drops of pure carbolic acid as a preservative. (2) Another violet ink is made by dissolving 1 part of methyl violet in 30 parts of distilled water; a second solution is made by dissolving 10 parts of gum in 20 parts of water and adding a few drops of acetic acid; the two solutions are then mixed.

White Ink.—(1) So-called white inks are, properly speaking, white paints, as a white solution cannot be made. A paint suitable for use as an ink may be made by grinding zinc oxide very fine on a slab with a little tragacanth mucilage, and then thinning to the required consistency to flow from the pen. The mixture requires shaking or stirring from time to time to keep the pigment from separating. The "ink" may be preserved by adding a little oil of cloves or other antiseptic. (2) White marks may sometimes be made on coloured papers by the application of acids or alkalis. The result, of course, depends on the nature of the colouring matter in each instance, and the effect of any ink of this kind would depend on the nature of the colouring in the paper. (3) White egg-shells are powdered in a mortar with clean water, and the powder is dried. Dissolve 1 part of white gum ammoniac in 3 parts of acetic acid; a gentle heat will aid this. Strain through muslin, and add 1 part of powdered egg-shell. To thin the ink, dilute with acetic acid. Write with a quill pen or sable brush. Pure whiting or Chinese white may be substituted for the egg-shell. (4) Another and simpler recipe is to mix flake white, French zinc white, white-lead, freshly precipitated barium sulphate, starch, or magnesium carbonate with a weak solution of gum arabic. The white substance must be reduced to an impalpable powder before mixing. (5) A solution of potash answers well on dark-

blue paper. Get two pennyworth of potash in a bottle and then mix it with about the same bulk of water. If it burns or turns the paper brown, it is a sign that the ink is too strong and wants diluting with more water. (6) Gum arabic, 80 grs.; water, 2 oz.; mix with sufficient whiting.

Zinc, Ink for.—The following are recipes for ink to write on zinc used for garden labels:—(1) Verdigris, 2 parts; sal-ammoniac, 4 parts; lampblack or animal charcoal, 1 part; water, 20 parts. First make the powders into a paste, and then add the rest of the water. Shake before using. (2) A solution of sulphate of copper, slightly thickened with gum, and carrying some sort of lampblack in suspension. (3) Dissolve chloride of platinum 1 part, and gum arabic 1 part, in distilled water 12 parts. Use this with a quill, and the zinc should be first cleaned with hydrochloric acid and sand. The writing, which will be a deposit of platinum black, will appear as a velvety black. If, when freshly written, the plate is dipped into a solution of cyanide of gold and potassium, and afterwards into dilute nitric acid (1 to 16), a permanent gold film will cover the writing, which cannot be removed even by acids.

Iron

Bronzing Iron (*see* Bronzing).

Casehardening Iron (*see* Hardening and Tempering).

Cement for Cast Iron.—This is made with equal parts of litharge, red-lead, and sufficient glycerine to form a paste. This cement is said to be waterproof, fireproof, and to resist the action of alkalis.

Cementing Iron Rails and Gratings to Stoves, etc.—For cementing iron railings and iron gratings to stoves, etc., the following mixture has been used with the greatest possible success; in fact, with such effect as to resist the blow of a sledge-hammer. The mixture is composed of equal parts of sulphur and white-lead, with about one-sixth proportion of borax, the three being thoroughly incorporated together so as to form one homogeneous mass. When the composition is to be applied, it is made wet with sulphuric acid, and a thin layer of it is placed between the two pieces of iron, these being at once pressed together. In five days it will be dry.

Cleaning Iron Filings.—Oily iron filings can be cleaned by treating them with petroleum spirit (paraffin oil would do if petroleum spirit cannot be obtained), then placing them on an iron plate, and heating over a burner until the spirit has burnt off; the iron filings will then be perfectly clean and dry.

Distinguishing between Cast Iron, Wrought Iron, and Steel.—Besides the difference in external appearance (cast iron untooled showing marks of the moulding), wrought iron is tough, and, when broken, has a fibrous appearance, while cast iron is shorter and crystalline in structure. If a drop of dilute nitric acid be placed on polished wrought iron, the stain that results will be of a greenish-grey colour, but will be blacker if the acid be applied to steel. The darker the spot, the more carbon is there present in the steel. Soft steel, when broken, is of a grey lustre, and when hard the fracture is silvery. The qualities of the different brands of steel vary to a considerable extent. A method of distinguishing iron from steel is to wash the piece of metal to be tested and then plunge it into a solution of bichromate of potash, with the addition of a considerable quantity of sulphuric acid. In from thirty to sixty seconds the metal can be taken out, washed, and wiped. Soft steels and cast iron will have assumed a regular ash-grey tint; tempered steels will have become almost black, without any metallic reflection; puddled and refined irons will remain nearly white, with metallic reflections on the part of their surface previously filed, the remainder of the surface presenting irregular blackish spots.

Iron Borings Cement.—For making joints in hot-water pipes, the quantities are, by weight, 80 to 100 parts of iron borings (which must be pounded if coarse), 2 parts of flour sulphur, and 1 part of powdered sal-ammoniac. The ingredients must be well mixed and moistened with water, this being done from half an hour to two hours before use, according to the weather. The joint is first caulked a little more than half full of yarn, then finished with the

prepared borings. The borings must be caulked in carefully, or the socket will be split as the joint sets, for the borings expand a little in setting.

Iron Cement.—Iron cement is used for filling up holes, cracks, and flaws in iron castings. It may be made as follows: Take by weight 2 parts of sulphur and 1 part of fine blacklead. Place the sulphur in an old iron bowl and hold over a fire till the sulphur begins to melt; next add the blacklead, and stir till all is well mixed and melted. Then pour on an iron slab or smooth stone. To use the composition, a sufficient quantity is broken up, placed in the hole, and "soldered" in by means of a hot iron, in the same manner as a tinsmith solders sheets. As the fumes of sulphur are very annoying, the material must be melted in a good draught.

Iron Liquor.—Iron liquor, also called acetate of iron, pyrolignite of iron, and black liquor, is manufactured in large quantities in Lancashire for the use of calico printers and dyers as a mordant, the operation usually being carried on at wood-vinegar works. Iron turnings, nails, old hoops, or any scrap iron, as free as possible from rust, are put into casks, and crude pyroligneous acid, about 7° Tw., is poured over them until they are well covered. The iron scrap is gradually dissolved in the acid, and to hasten the action the contents of the barrels are kept at a temperature of about 148° F. The mixture is stirred from time to time, and the tarry matter which collects on the surface skimmed off. The action is considered complete when the acid can take up no more iron, or is "killed," which is the term used in the trade. The resultant liquor is allowed to settle for a little time and is then evaporated to about 20° Tw., or for certain purposes is made even stronger than that. Acetate of iron is also sometimes prepared by the consumer by a process of double decomposition as follows: Sulphate of iron (copperas) is dissolved in hot water, and added to a solution of acetate of lime, the proportion being about 5 of copperas to 1 of acetate of lime. This method is much more expensive than the one described above, and the iron liquor thus produced is not so stable an article, and cannot be relied upon in giving such uniform results, as the liquor made from the crude acid. The common iron liquor made from the crude pyroligneous acid keeps much better than a pure acetate, a fact no doubt due to the presence of certain tarry and volatile oils in the crude acid which prevent the rapid oxidation of the manufactured article. Nitrates of iron and copper are prepared much in the same way as in making the acetate, nitric acid being used for the acid, and good clean scrap iron (iron turnings, etc.) or copper added in small quantities at a time until the acid is "killed." This operation with nitric acid must be conducted with great care, as the fumes given off are highly dangerous to anyone inhaling them. The process should be carried on in some outhouse where the fumes can be conveyed to a chimney.

Oxidising Iron (*see* Bronzing *and* Oxidising).

Rusting of Iron (*see* Rust).

Softening Cast Iron.—To soften cast iron, heat to a bright glow, and gradually cool under a covering of fine coal dust, etc. Small objects are packed in quantities in a crucible, in a furnace or open fire, under materials which, when heated to a glow, give out carbon to the iron. They should be heated gradually, kept at a bright heat for an hour, and allowed to cool slowly. The substances recommended to be added are cast-iron turnings, sodium carbonate, or raw sugar. If only raw sugar is used, the quantity should not be too small.

Tinning Iron (*see* Tinning).

Isinglass

Isinglass, says Mr. R. Livingston Fernbach in "Glues and Gelatine," is prepared chiefly from the swimming-bladder of the Russian sturgeon, and is marketed in various solid forms such as sheet, purse, lump, pipe, honeycomb, etc. It is a very hard, transparent and practically colourless substance. It is the most powerful adhesive known, and is used chiefly by brewers and wine merchants for clarifying purposes; pure gelatine, which is chemically the same thing as isinglass, cannot be used

in this way. Many substitutes for isinglass are offered for sale, but they possess only to a slight degree the excellent properties of the genuine.

Dissolving Isinglass.—Isinglass may be easily dissolved by boiling with water under pressure in a digester. The digester is an iron or copper pan, with a lid which can be bolted on and made tight with rubber packing; in the lid is a valve fitted with a lever and an iron weight to regulate the pressure at which steam will blow off. In dissolving isinglass by ordinary boiling, if alkali is no detriment to the material, a very little caustic soda added to the water will help to bring it sooner into solution. Isinglass can also be dissolved by placing it in a bottle, just covering it with strong acetic acid, and melting down by heating the bottle in water; such a solution used hot is a good cement for leather. Isinglass is not soluble in any spirit. If dissolved in water, and spirit of wine added at a certain strength, all isinglass will be thrown out of solution.

Isinglass Cement for Metal.—This consists of 100 parts of very thick isinglass solution and 1 part of nitric acid. Stir the nitric acid evenly into the solution, paint the metallic surfaces with this liquid, and then press the two firmly together. The object of the nitric acid is to make the surfaces rough by corrosion; but its use hinders the drying of the cement. It is therefore necessary to expose the cemented metallic surfaces to a higher temperature for a time to hasten the drying.

Ivory

Ivory differs from bone in its finer structure and greater elasticity, and in the absence of those larger canals which carry blood-vessels through the substance of bone and appear upon it as specks or streaks, according as the bone is cut lengthways to or across the grain. On examining a cross section of a tusk cut at a distance from the growing pulp, its middle is seen to be occupied by a darkish spot of different structure; this is the last remains of the pulp roughly calcified. The outer border of the tusks consists of a thick layer of cementum (commonly called "bark"), with which the whole tusk is coated, and the rest is ivory. The different ivories are, the mammoth, found in Siberia; African, Indian, Ceylon, and Desert, found in the sands. The best ivory is African. The largest quantity comes from Africa; less than one-fourth comes from India. African ivory is closer in the grain, and has less tendency to become yellow by exposure than Indian ivory. When first cut it is semi-transparent, and of a warm colour, but as it dries it becomes much lighter and more opaque. Ivory also shrinks considerably during the drying process, so that it is necessary to season it like wood when such things as box lids are to be made from it. In buying ivory, it is not always possible to judge its quality before the tusk is cut up. The tusk should be smooth and polished and of a deep copper colour, and should not show any large cracks. As about one-half the length of a tusk is hollow, when cutting one up, great care must be taken to do this to the best advantage. Of other ivories, the canine teeth of the hippopotamus furnish an ivory harder and whiter than that of the elephant, and less prone to turn yellow. The tusks of the walrus furnish ivory of a dense and rather imperfect consistence. The spirally twisted tusk of the narwhal, the teeth of the sperm whale, the ear bones of whales, and the molar teeth of the elephant, are also made use of as sources of ivory.

Bleaching Ivory.—Ivory is best bleached by exposing it to sunlight. The ivory should be carefully rubbed with powdered pumice and water, and then exposed while still wet to the sun. The bleaching agents that are used consist of dilute solutions of sulphurous acid and bleaching powder; the ivory should not be kept long in these solutions. Another bleaching agent is hydrogen peroxide that has been rendered alkaline with ammonia; the ivory may be left in this solution until properly bleached, as the solution does not injuriously affect the ivory. Restoring the colour of yellowed ivory by bleaching is a tedious process, and very often the bleached articles will show signs of cracks in a short time. Most goods can, however, be greatly improved, and in many cases the original colour

restored, by scouring with finest grade pumice powder and methylated spirit, and afterwards imparting a high degree of lustre by means of putty powder rubbed on with new soft chamois.

Cement for Ivory.—Dissolve in about 30 parts of water 2 parts of white glue and 1 part of isinglass. This should be strained and evaporated to about 5 parts. A small quantity—say, $\frac{1}{30}$ part—of gum mastic should be dissolved in $\frac{1}{2}$ part of water, and added together with 1 part of white zinc. The whole should be warmed before use. A simpler method is to use finely powdered quicklime, made into a paste by mixing with white of egg. This should be applied to the broken parts, which should then be clamped together and left for a day or so.

Choosing Ivory.—In choosing ivory, a pretty grain rather than strong markings is desirable; but the finest quality, in the hard variety which is generally used, is the closest and freest from grain. Then it should be a pure white, says Mr. Maskell.

Dyeing or Staining Ivory.—Wash the articles in a strong solution of common washing soda to free them from grease and open the pores; then dip in solutions of sulphuric acid to obtain varying shades of brown according to the strength of the solution and time of immersion, which can only be gauged by experiment. To stain ivory yellow, dip the articles first into a strong solution of bichromate of potash, and then into a boiling solution of acetate of lead. Another method is to boil the articles in alum solution, 1 lb. to 1 qt. of water; then plunge them into a second solution, $\frac{1}{2}$ lb. turmeric, $\frac{1}{4}$ lb. pearlash, boiled in $\frac{1}{2}$ gal. of water. Allow them to remain in several hours. In all cases take the precaution to plunge the articles in cold water before drying off, to avoid the possibility of end-shakes and cracking. Polish with whiting and spirits on a pad of brown cloth. Wholly different methods, but equally satisfactory, are as follow: Ivory should be washed thoroughly in hot soapsuds and rinsed several times in clean soft water before dyeing is attempted. The pieces should not be handled with the fingers; such handling always tends to leave stains on the ivory, and to prevent dye penetrating evenly. After washing in soap and water the ivory should be dipped in dilute nitric acid (1 part of acid to 40 parts of water) for a few minutes, then rinsed again in soft water. For dyeing, a solution of any aniline red may be employed, or the colouring may be done with cochineal, which is the oldest method. For cochineal dyeing, make two solutions: (*a*) A solution of chloride of tin (1 part of the salt to 16 parts of water); (*b*) a solution of cochineal made by boiling 1 part of cochineal in 10 parts of water, adding a little ammonia, and straining. The ivory should be placed in (*a*) solution, heated to boiling, removed, and washed in clean water; next placed in (*b*) solution and heated to boiling in the same way; then thoroughly washed in clean water. The ivory should not be handled throughout the whole of this process, the pieces being lifted with wooden tongs. A piece of white bone should go through the treatment first, in order to see whether the dyeing can be done satisfactorily.

Gold-lining Ivory.—To gold-line ivory, paint in the pattern with a fine camel-hair pencil moistened with gold chloride, and then hold the ivory over the mouth of a bottle in which hydrogen is being generated by the action of dilute sulphuric acid on zinc waste. The auric chloride is thus reduced to a thin but durable film of metallic gold.

"Hard" and "Soft" Ivory.—Mr. Maskell says that "hard" or "bright" ivory is harder to cut with the saw, or other tools, than the "soft" variety. It has not necessarily a coarser grain; the quality of the grain is about equal in both descriptions. The terms are difficult to define exactly. The expert is guided by various considerations—by the shape of the tooth, for example, tapering to a fine point, or blunt — by the colour and quality of the bark or skin, and by the degree of transparency.

Polishing Ivory.—This may be done by hard, medium, and soft revolving brushes with wet whiting and water, finishing with a soft polishing bob charged with dry whiting or with putty powder. To polish ivory by hand, make a pad of thick flannel

or blanketing and rub with whiting and water; finish with a new pad and dry whiting or putty powder. When finished, stand in the sun to bleach, if desired. The following directions apply to the cleaning and polishing of an ivory tusk, the surface of which is somewhat corroded. With a blunt knife first scrape away the scaly matter until the ivory below begins to show up all over. Then scrape with pieces of broken glass, using the sharp edges, or a steel wood scraper. Continue this operation until all protuberances are worn down and the entire surface is moderately smooth. Next use coarse glasspaper, followed by medium, and then fine. Now rub well with fine emery powder, moistened into a paste with lard oil. Follow this application with one of powdered pumice and oil for a considerable time until a polish begins to appear. Finally, a vigorous friction with putty powder and the palm of the hand will complete the operation. Such work, to be carried out successfully, needs a great expenditure of time and "elbow-grease."

Removing Grain Marks from Ivory.—Scrape the ivory, being careful to keep to the original contour. A plan adopted with valuable pieces is to engrave a design on the surface, and to fill with black ink made by dissolving sealing-wax with spirit. Leave this to set, then polish off, thus hiding the objectionable marks.

Removing Grease Stains from Ivory.—Soak the ivory in best turpentine, letting it remain for a night and a day, and then rub off with whiting. This will bleach the ivory and remove the stains. Be careful not to allow the turpentine to soak into the joints of the article.

Softening Ivory.—To soften ivory and render it flexible, the following is said to be successful: Put pure phosphoric acid (specific gravity 1·13) into a wide-mouthed bottle or jar that can be covered, and steep the ivory in this until it partially loses its opacity, then wash the ivory in cold soft water and dry, when the ivory will be found soft and flexible; but it regains its hardness in course of time when freely exposed to air, although its flexibility can be restored by immersing the ivory in hot water. Another softening fluid is prepared by mixing 1 oz. of spirit of nitre with 5 oz. of water, and steeping the ivory in the fluid for four or five days. To restore the hardness to ivory that has been softened by the above methods, wrap it in a sheet of white writing paper, cover it with dry decrepitated salt, and let it remain thus covered for twenty-four hours. The decrepitated salt is prepared by strewing common kitchen salt on a plate or dish, and standing it before a fierce fire, when the salt loses its crystalline appearance and assumes a dense opaque whiteness—due to the expulsion of the water of crystallisation.

J

Japan Black

JAPAN BLACK is really a better quality of Brunswick black, composed of boiled linseed oil, asphaltum, and gum anime. Without special plant it is costly and unsatisfactory to make it. It is better bought ready made.

Jar, Cutting (*see* Earthenware and Glass)

Jet

This is a fossil substance, hard and black, found in beds of lignite or brown coal, chiefly near Whitby, Yorkshire. It is inflammable and takes a high polish. Its fracture is of a glossy and undulating nature. Its chief use is in the making of jewellery and fancy articles. The ancients knew of the property by which jet (in common with amber and, as is now known, a host of other substances) has the power when rubbed on a piece of flannel or silk of attracting to itself dust and similar light bodies.

Cementing Jet Brooches.—For this purpose shellac is used. To fasten the back on a jet brooch warm the metal back of the brooch, and run the shellac upon it by means of a lamp flame or a blowpipe. Let it flow well and "take" everywhere. Then holding the brooch in one hand, and the metal back in a pair of pliers in the other, warm them one on each side of a flame. The jet must be hot, but not burnt; the shellac must run. Then bring brooch and back together with pressure, and work them about slightly. Allow them to cool slowly. When cold, give the back a vigorous pull with the fingers to test the adhesion.

Working Jet.—Jet can be easily cut with a fine fretsaw, and may be carved with ordinary carving tools. Jet ware may be brought to shape by rubbing on a flat block of sandstone, and polished first on a wood block, and lastly on a block covered with thick felt, sprinkled with putty powder or rouge; or revolving wheels may be used. Any good spirit varnish will serve as a glaze for jet ware, especially if a small quantity of black (soluble in spirit) be added.

Jewellery

Cleaning Jewellery.—Gold chains, and other articles of gold and silver having no stones set in them, may, for cleaning, be well washed in strong soda water and soap, being afterwards rinsed in plenty of cold water and dried in sawdust in a warm place. Rings or other articles bearing stones (except pearls) may also be served in the same way, and the settings may be well cleaned out by fine-cut wood pegs and pieces of thread passed through the small openings. When polishing, use a soft watch-brush charged with a little dry rouge for the engraved or chased parts, and rouge and water on the bare fingers for the plain parts. A wash after this is necessary to remove the rouge from the crevices. Rings, etc., having half pearls set in sinks must not be made wet all over, for if water gets behind the pearls they will be discoloured. Whole or half pearls set open in claws may be washed in cold water. Some cleaners use prepared chalk or Goddard's

plate powder mixed with weak ammonia (1 of ammonia to 10 of water) for cleaning instead of soda water. Or Walker and Hall's plate-cleaning alkali is used. With these preparations, sprinkle a little on a soft watch-brush and brush the articles over. Leave to soak for a minute. Then wash off with hot soap and water and treat as above. Cleaning stone settings with tissue paper is bad, and is not to be recommended. The friction caused wears out the slender prongs, and helps to loosen the stones. Do not touch the setting with anything in cleaning except a soft brush. Stone settings can be washed with soap and water, then rinsed thoroughly in alcohol and dried in boxwood sawdust. Diamonds should be kept clean to be brilliant. The top becomes electric from the friction in wearing, while the back of the stone will become covered with a dust or lint attracted thereby, this destroying the brilliancy. To clean diamonds, wash thoroughly with soap and water to which a few drops of ammonia have been added; rinse in pure water, immerse for a moment in alcohol, and dry in boxwood sawdust. Sawdust for cleaning jewellery should come from whitewood. All sawdust is not equally good; some, like that of the chestnut and oak, blackens the gilding; others are not sufficiently absorbent and leave the object sticky. The best sawdust to use is that from whitewood such as the box, poplar, linden, pine, and fir, provided it is free from resinous matter. Have the sawdust slightly warm in use.

Diamond Setting.—The setting of a diamond in a gold ring is not likely to be attempted by the handyman, but a description of the process may be interesting. Assuming that the ring is a plain one and has never had a stone set in it before, also that the diamond is a small one, the first thing to do is to drill a hole right through the ring a little smaller than the stone. Open this out by filing so that it is larger underneath, and in shape to the outline of the stone. With a hand graver, cut a slight ledge round its top edge for the stone to lie in. Solder four small beads of gold on to the ring just outside the ledge cut for the stone, then, having placed the stone in position, a portion of the four beads can be forced over its edge with a small flat-face punch. Or, instead of four beads, four small upright stems may be soldered on (being afterwards shaped up by filing into neat claws), and simply bent over the edge of the stone by a burnisher. The soldering must be done with gold solder, using borax as a flux. To make a star setting for a single stone, a hole is first drilled and opened out to a little smaller than the stone; a ledge is then cut round for the stone to lie in, leaving a depth of gold above its edge sufficient for the corns or claws to press over it. The star points are then cut with a graver, leaving a corn in the centre of the broad base of each. This corn is undercut at the back so as to facilitate bending. The stone is then placed in, and the corns bent forward so as just to hold it. A small punch and light blows all round equally will bend the corns over the edge of the stone firmly. The ring can be conveniently held on a tapered stick.

Gilding Jewellery containing Gems.—Precious stones in hot gilding solution are liable to crack. The "Jeweller and Metalworker" says that the topaz is the stone with which there is the greatest risk; it will crack immediately if put cold into a hot liquid of any kind; it should first be put into a cold liquid, and then the temperature slowly raised, for by that means the degree of warmth imparted to the stone is very gradual. Amethysts should be treated in the same manner. Pearls must not be put into pickle in the cleaning of the work previous to gilding, neither hot nor cold, but they can be gilt in a moderately hot gilding solution without injury. Stones set with foils at the back must not be immersed in liquids, hot or cold, or the liquid will penetrate to the back and spoil the foil. Turquoises, opals, cats'-eyes, jet, shell, ivory, bone, or celluloid will bear very little heat indeed; nevertheless, they may be put in a warm gilding solution without damage, providing the temperature is not too high and the solution is in good workable form for the deposit to take place almost immediately; but it is advisable to dip them in lukewarm water before entering the gilding liquid, as a precaution.

Articles containing rubies, emeralds, sapphires, garnets, aquamarines, and pastes may all be gilt in a hot solution if the conditions set forth above are complied with. A cold solution would require to be much richer in gold than a hot one.

Jewellers' Cement for Spangles and Pins.—This can be made by melting together in a covered vessel 7 parts of indiarubber and 2 parts of sulphur. In using, a small quantity of the cement is melted and applied to the surfaces previously heated in the flame of a spirit lamp to remove all moisture.

Pearl Setting.—The holes for the pearls are drilled just deep enough in a ring for the edges of the pearls to come a little below the edges of the holes; these holes are made with a flat-bladed drill or pearl drill. Having fitted all the stones, cut the side grooves, leaving small pieces of gold between the stones and one piece at each end. Place all the stones in position, and with the point of a strong spit sticker push over the edges of the stones the little pieces left. These pieces are next formed into grains by applying a grain tool on the top of each with a little pressure, working them into shape. The side grooves are then brightened by cutting them over again with a spit sticker, the back of which has been polished to give a smooth cut. For fixing pearls on pins, brooches, etc., a thin paste made with the finest plaster-of-Paris and water is generally used. Some workers mix a little white of egg with the paste to make it adhere more firmly.

Removing Gems from Settings before Soldering.—The "Jeweller and Metalworker" says that the stones are generally removed by means of a pheon, different kinds of scorpers, and wax sticks. The greatest care should be exercised to prevent breaking the stones and settings. Claws, and the little beads of metal usually found surrounding stones, and known in the trade as "grains," should be raised only just sufficient to allow of the stone being withdrawn by means of the wax stick, for if they are forced back too far they are liable to break off, being naturally hard, and considerable trouble will be experienced with them when once broken off. The safest way to raise the claws of grains will be by inserting the pheon or flat scorper between each claw or grain and its fellow, taking care that the lifting tool presses on the head of the ring, which should act as the fulcrum, and not on the stone. A careful leverage will, in this manner, raise the different settings sufficiently to enable the stones to be readily pulled out with the wax. Claw, gothic, coronet, gipsy, thread and grain settings may thus be treated. Point, cramp, and Roman settings will need to be cut a little round the stones, and then withdrawn with strong wax.

Removing Tight Finger-ring.— To remove a tight finger-ring, pass the end of a fine string underneath the ring, and then wind it evenly around the finger toward the tip, as far as the first joint. Take hold of the end of the string which has been passed through the ring, and slowly unwind, when the ring will slowly move upwards.

Soldering Gem Rings Set with Stones.—According to the "Jeweller and Metalworker," diamonds are of the few stones that can with safety be left in while soldering, if the soldering is to be done near the stones; and some of these, if heated very hot, will become scorched. They unite with the oxygen of the air when unprotected from it at a great heat, and fuse on the sharp edges, emitting carbonic acid gas; the risk is increased when the ring is made of thick solid gold. In the manufactory, it is a common practice, before soldering a faulty ring, to coat diamonds with a creamy paste of boracic acid, to protect them from the action of the air; even then, if the stone contains a flaw, it is liable to crack or a piece to flake off, as all such substances expand with heat, and if one part is heated hotter than another the difficulty is increased. The heat should therefore always be applied gradually. Fancy coloured stones, such as sapphires, rubies, emeralds, amethysts, garnets, aquamarines, and those composed of quartz, and even pastes, will resist a certain amount of heat properly applied, and a ring set with any of these stones may be hard-soldered at the back without the stones being removed. But if they require soldering near the stones these must be taken out. Various

devices are resorted to in soldering articles which have stones set in them in such a manner that it is inconvenient and expensive to take them out. Among the successful devices are the following: Wet tissue paper is wrapped in several thicknesses round the stones to keep them cool. This keeps the flame of the gas-jet off, and by the moisture contained in the wrapping equalises the temperature, and prevents the heat required for hard-soldering reaching the stones. Wet whiting pasted all over the part containing the stones is preferred by some workmen, and by others slices of raw apple or potato are employed to cover up the exposed portion of the article in the same manner. The shanks of rings may readily be hard-soldered with a quick flame and by one experienced at the work when set with any of the foregoing stones. Rings or any other articles set with pearls, turquoises, opals, cats'-eyes, jet, shell, ivory, bone, or celluloid, will bear no heat whatever, and these must all be removed before soldering, unless this can possibly be done while they are immersed in water.

K

Kettles

Bending Kettle Spout (*see* Tubes).

Removing Fur Deposit from Kettle.—The general method of removing the fur is to chip it out with a chisel or other sharp-ended tool, and a perfect method of preventing deposition has yet to be discovered. An old-fashioned remedy is to have a marble rolling about in the kettle; when this has

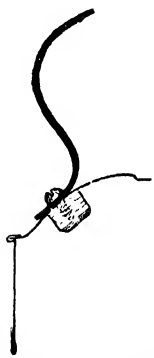


Fig. 418.—Fastening Kettle Handle.

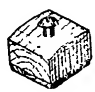


Fig. 419.—Wood Block and Screw for Fastening Kettle Handle.

increased in size by the deposit it may be removed and the chalky matter chipped from it before replacing. "Octopus" fur collector, or some oyster shells, can be used in the same way as the marble. A chemical method of removing the fur is as follows: To 1 part of strong hydrochloric acid add 9 parts of water; fill the kettle with this, and allow it to act until the violent evolution of gas from the scale ceases; then immediately wash the kettle with water several times. If the kettle is of iron the acid must not be left in too long, or it will attack the kettle after the scale is dissolved. In some cases, merely boiling some common whiting in the vessel (watch carefully, as it soon froths over), and then washing out, is found to soften the fur. If necessary, repeat the process. This does not damage the vessel as chiselling is apt to do. A wire should be passed up and down the spout until clean.

Repairing Kettle Handle.—A simple and cheap method of fastening a kettle handle that has come off is illustrated by Fig. 418. The method merely requires a round-headed screw, with a wood block inside the kettle (*see* Fig. 418). First bore the wood block (Fig. 419), and drive the screw nearly down. Then remove the screw and make sure that it will pass through the holes in the handle and kettle top. Next, firmly holding the block of wood inside the kettle, drive the screw home to hold the handle tight, and then serve the other side of the handle the same. A little contamination of the water boiled in the kettle will result at first, but will not be harmful afterwards.

Repairing Rusty Kettle.—For stopping a hole in a rusty kettle, many compositions have been tried, with more or less unsatisfactory results. Consequently they cannot be regarded as practical recipes. The following method is advised. With a sharp knife, scrape the bulk of the rust from the kettle, and apply raw spirit of salt frequently. This in a short time will remove the remaining rust, leaving the surface of the metal clean, when the hole can be soldered over in the usual manner by using killed spirit as a flux.

Replacing Kettle Spout.—Kettle spouts are generally soft-soldered to the body. When replacing an old spout, first thoroughly clean the spout and body, where it

is to be soldered, by filing and rubbing with emery cloth, then tin the end of the spout and round the hole in the body with the copper bit. Place the spout through the hole in the body from the inside, and see that it fits tightly where the flange upon the end of the spout butts up against the inside of the body; then, using killed spirits as a flux, well soak the solder round the flange on the spout, and also leave a body of solder floated round the junction formed by the body and spout on the inside of the kettle.

Key Fitting (*see* Lock Repairing and Key Fitting)

Kieselguhr

Kieselguhr (infusorial earth) is a siliceous material composed largely of the skeletons or sheaths of minute animalculæ called diatoms. This substance is very light and floury, hence it is also known as "fossil meal." There are several other siliceous materials allied to kieselguhr, among them being tripoli powder, mountain cork, mountain wood, diatomite, etc. Kieselguhr is used as a non-conducting covering for steam boilers and steam pipes, and for refrigerators, and in the manufacture of dynamite. The pipe and boiler covering is made of kieselguhr mixed with about one-tenth of its weight of common dried clay, with the further addition of cowhair as a binder. The finest varieties of kieselguhr, when free from grit, are used as polishing substances for metals, in the preparation of metal polishes, and as an ingredient in certain soaps.

Knives

Cleaning Knives and Forks.—Powdered Bath brick, made into a paste with paraffin and applied with a piece of flannel, quickly removes all dirt and rust; and a little dry powdered Bath brick applied with a soft rag, after the above treatment, leaves a brilliant polish.

Fixing Knife Blades in Handles.—The best method of fixing knife blades in handles is as follows:—Fill the handles with powdered resin mixed with silver sand, heat the knife tang, press it firmly into the handle, and cool in water. Powdered pitch and sand may be used in a similar way, but the former method is more generally used and is better. The following method is said to be thoroughly reliable: Mix together powdered alum and common river sand in equal proportions, and melt in a plumber's ladle or in an iron spoon. Pour the mixture into the handle, which should previously have been warmed, and force in the tang; then set aside for an hour or so to cool. Another cement for fixing the tangs of knife blades into the handles is made by mixing 4 parts of resin, 1 part of beeswax, and 1 part of plaster-of-Paris. Put the cement powder into the hole, heat the tang, and press home.

Removing Knife Blades from Handles.—Loose blades are a source of risk and should be removed and refixed. To remove them, immerse the handles in boiling water until heated right through, and then pull blade and handle apart. Refix as described in the preceding paragraph.

L

Lacquering, Chinese and Japanese

THIS process is applied to wood, not to metal, and is known in a number of modifications. The wood to be lacquered is absolutely dry, and receives not less than thirty-three successive applications to produce perfect work. When the lac coating is about ·19 in. thick it is ready for the engravers. The Chinese, like the Annamites, mix oil of trau or aleurites with the lac, and the greatest care is exercised in drying the different layers in dimly lighted rooms specially fitted up for the purpose; the necessary moist atmosphere is maintained by systematically watering the earth which covers the walls of this "cold stove." In Japan the wood is well prepared, and the surface made up with pure lac, dried, pumiced, and coated with a mixture of crushed flax and glue. A layer of lac is applied and covered with a fine linen fabric, all parts of which should adhere perfectly. This, suitably dried, serves as a foundation for the successive applications of thirty-three layers. After each coat the surface is rubbed with a fine grained stone before drying in the moist chamber, and the greatest precautions are taken to avoid impurities and dust. The final polish is obtained by rubbing with the powder of calcined deer horn, and the work then can receive the gold or silver. The design to be reproduced is drawn on very fine paper and treated with a mixture of glue and alum, and on the back of the paper the outlines are traced with a brush of fine rat hair, dipped in lac previously boiled over a brisk charcoal fire. This paper is applied to the object and made to adhere by rubbing with a spatula of minoki wood or of whalebone. On removing the paper, the design is found transferred damp, and is rendered more distinct by applying white powder with a piece of wadding. With one of these transfer papers twenty reproductions can be secured, and the lines can be retraced with the boiled lac, it is said, so as to procure copies almost indefinitely. The boiled lac causes the outlines to remain damp, and imperfections can be corrected. In this case the outlines are retraced with a pencil of hare's hair lightly charged with a preparation of lac not boiled. This operation is delicate and requires great care not to displace the lac from the original outlines. The whole is covered with fine gold, silver, or tin powder, as desired, by means of a piece of wadding. If the object is large the process is conducted successively on separate parts, and at each step the piece is dried in a damp room, tightly closed to exclude the dust. When the metallic coating has hardened sufficiently, the piece is taken out, and the design is covered with a fine transparent lac laid on with a brush of hare's hair. The next part is not touched until the preceding is quite dry. All the parts of the object are finally rubbed with a piece of camellia-wood charcoal in order to equalise the thickness, and then polished with the fingers moistened with a mixture of calcined deer-horn powder and oil.

Chinese Lacquer Work.—The red gold and pale yellow effects seen on Chinese lacquered cabinets, etc., are produced by the aid of lead, tin, or silver foil laid upon a smooth surface and coated with various gum varnishes. Very effective panels may

be made upon this principle, and these may be utilised in the construction of screens, cabinets, etc. When sheet metal is used it should be perfectly free from marks of any kind, and should be highly polished. If wood is employed, it must be planed very flat and then smoothed with fine glasspaper, being afterwards sized and primed with two coats of white-lead and yellow ochre mixed with drying oil and a little oil size; rub down each coat with pumice powder and water. Next coat with flat black, and rub down, first with finest glasspaper, then with a dry cloth, and finally with the palm of the hand, taking great care that particles of dust do not remain. Now give an even coat of a mixture of two parts of black japan and one part of gold size, and after rubbing down, when dry, with pumice powder and water, the panel is ready for the silver leaf. The portions to be treated with foil are then coated with gold size to which has been added a small proportion of linseed oil, and when these parts are of the proper "tackiness" the leaf or foil is laid on, as in gilding. When dry and the surplus metal removed, the subjects are toned, shaded, and tinted; for the darker shades, dragon's blood mixed with turpentine is used; gamboge forms the lighter shades. All the transparent oil colours, employed by artists, may also be used for various effects upon the foil. In, say, a landscape, figures, the sun, and water may be covered with foil, whilst the other portions of the landscape may be executed in oils, and should be suggestive rather than detailed. When dry, wash with water containing a very little soda, and finish by varnishing.

Japanese Lacquer Work.—The Japanese, who have been masters in the art of the application of lacquer to articles of commerce from ancient times, have three processes—extraction, application, and decoration—and the methods are the same to-day as they were ages ago. The lac is taken from an incision in the trunk of the *Rhus vermicifera,* and contains approximately about 70 per cent. of lac acid, 4 per cent. of gum arabic, 2 per cent. of albumen, and 24 per cent. of water. It is strained carefully and deprived of moisture. It next receives an admixture of gamboge, cinnabar, acetous protoxide, or other colouring matter. The article to be operated on is covered with a layer of Japanese paper, fixed on with rice paste to which a little lacquer has been added. This prevents any exudations from the wood reaching the overlaid lacquer and interfering with the high polish. There are many operations of sizing, lacquering, polishing, drying, rubbing down again, and so on, till after a number of days it has a smooth lustre with a dark grey surface. The next work is that of the artist, who sketches the outline on the article with a paste of white-lead, and then proceeds to fill in the design with gold and colours, afterwards laying over all a coat of translucid lac, and carefully polishing it all over. If any of the parts are to be in relief, these are built up with a putty of black lacquer, white-lead, camphor, and lampblack. The real secret, however, is great care and infinite patience.

Lacquering Metals

Metals are lacquered to protect their polished surfaces from atmospheric influences. The surface to be lacquered must be thoroughly cleaned, and only the best quality lacquer and brushes should be employed. Full details of the process are given on p. 91 under the heading, "Brass: Cleaning and Restoring Bedstead Brasswork."

Lampblack

In producing the various grades of lampblack, soot oil, which is the last oil obtained in the distillation of coal tar, freed from naphthalene as far as possible, is burned in a special furnace. In this furnace is an iron plate, which must always be kept glowing, and upon this plate the soot oil trickles from a vessel fixed above. It is decomposed, and the smoke (soot) rises into four chambers through small apertures. When the quantity of oil destined for decomposition has been used up, the furnace is allowed to stand undisturbed for a few days, and only after this time has elapsed are the chambers opened. In the fourth chamber is the very finest lampblack for lithographers' use; in the third is the fine grade employed in

making printers' ink; while the first and second contain the coarser soot, which, well sifted, is sold as flame lampblack. From grade No. 1 the calcined lampblack for paper-makers is produced. For preparing this lampblack, iron capsules with closing lids are packed tightly with the coarse lamp-black, and the cover is smeared with fine loam. The capsules are next placed in a stove and semi-calcined, this causing the oils to evaporate and the remaining lamp-black to become odourless. The capsules are allowed to cool for a few days before being opened, as the soot dries very slowly, and easily ignites in contact with air if the capsules are opened too soon. For the purpose of preparing completely calcined lampblack, the semi-calcined substance is packed into fresh capsules, these being closed up well. After a calcination lasting two days, the capsules are opened, and the lampblack is found to be in compact pieces. For the manufacture of soot-black another furnace is employed. Asphalt or pitch is thrown in through the doors, air being excluded as far as practicable, and the smoke escapes through the chimney to the soot chambers 1, 2, 3, 4, and 5, and in these chambers the soot assorts itself. The asphalt or pitch is burned up completely, and the furnace is then left unopened for several days; then the outside doors are slowly opened and air is admitted. Later on the doors can be opened altogether, if the soot-black is quite cool. Chamber 4 contains the finest soot-black, and this is used in the manufacture of leather-cloth and oilcloth. In the other chambers is fine and ordinary flame-black, which is sifted and packed in suitable barrels. Calcined lampblack may also be produced from it, the operation being the same as for oil-black.

Lamps

Acetylene Lamps (*see* Acetylene).

Care of Oil Lamps.—This is chiefly a matter of keeping them scrupulously clean and using common sense. In lighting a lamp the wick should be turned down and left down until the chimney and shade are replaced; then gradually turn it up. This will save the chimney. A lamp should be extinguished by turning down the wick and then pulling the extinguisher if there is one; if not, blow across the top of the chimney, but not down into it. Once in every two or three weeks wash the burner in strong soap or soda water. Boiling in soda water is hardly necessary. A few bubbles of air in the oil tank of a reading lamp will often prevent a free flow of oil through the narrow pipe which carries the oil from the tank to the burner, causing the lamp to give a dim, yellow light. When filling the reading lamp bear this in mind, and fill the tank to the top, breaking any air bubbles that may appear.

Cementing Broken Reservoir.—The following are two cements for mending cracked or broken glass lamps to hold paraffin oil. Mix plaster-of-Paris with white of egg and a little vinegar. Allow this twenty-four hours after applying in which to become hard. Mix 3 parts resin, 1 of caustic soda, and 5 of water with half their entire weight of plaster-of-Paris. Use at once and allow forty-five minutes in which to set.

Cementing Collars or Rims to Glass Reservoirs.—(1) Rings or collars are cemented on to reservoirs with plaster-of-Paris, which is considered to be stronger if prepared with a saturated solution of alum in clean water. (2) Powdered alum forms a simple but thoroughly reliable cement. Clean the rim and neck from grease, invert the rim, fill its cavity with powdered alum, and place on the top of a hot range or stove. When the alum begins to get pasty, press the neck of the lamp firmly into place, remove from the stove, and set aside to cool. In about five minutes the lamp will be ready for use. (3) Use 1 part of plaster-of-Paris well mixed with 2 parts of resin soap. Zinc white or slaked lime can be substituted for the plaster-of-Paris.

Cementing Reservoir to Stand.—Plaster-of-Paris is frequently used for cementing lamp bodies into their stands, but it is not very serviceable, being easily dislodged by heat or vibration. Keene's cement (which is plaster-of-Paris steeped in a saturated solution of alum and reburnt) is much stronger. A very strong cement may also be made by taking a solution of zinc chloride, specific gravity 1·5, adding 3 per cent.

of borax, and then sufficient zinc oxide to form a stiff paste. Apply at once, as the cement sets rapidly.

Cleaning Lamps.—The "Bazaar" says that absolute cleanliness in the care of a lamp cannot be secured by any amount of external daily wiping after filling, for periodical cleaning of the burner and adjacent parts is necessary; these must be taken apart for the purpose. By placing the whole lamp top in soda water and scalding or even boiling it, a lot of the accumulated dirt will doubtless be removed; but this is a somewhat lazy way of performing the work, and the burner should certainly be taken apart, as its construction may be perfectly understood by anybody. First remove all parts that unscrew, and then by the aid of a screwdriver take off the slotted cap which fits on like the lid of a tin, having perhaps a punch-mark or groove to keep it in position; the cap will be found to go on again very easily. The extinguisher may be removed by drawing out the pin which passes through the lever; this lever can then be withdrawn, and the spring-closing shutters can be pulled off the wick-tubes. At the bottom will be found a perforated casing (perhaps two or three), which must be brushed either with or without hot water; also scrape off all corrosion from the wick-tubes caused by the burning oil and then wash them in hot water. When dry, put together again as before. When a lamp needs the above treatment, the air supply will be found to be impeded, and the chimney will get overheated and either crack or become frosted from within.

Cleaning Oil Lamp Globes.—For cleaning oil lamp globes so as to remove from them unsightly grease spots, and to restore the handsome matt appearance of polished glass, pour two spoonsful of a slightly heated solution of potash into the globe, moisten the whole surface with it, and rub the stains with a fine linen rag; rinse the globe with clean water, and carefully rub dry with a fine, soft cloth.

Cleaning and Reburnishing Brasswork of Lamp.—Take the lamp to pieces; then, to remove the old lacquer, immerse in hot solution of potash or soda, 1 lb. to a gallon of water. Ordinary carbonate of soda will do, but is not quite so effective as the potash. When the work is fairly clean, procure some common yellow nitric acid (aquafortis) and tie the articles together with copper wire; now warm them to a temperature of about 212°, and dip in the aquafortis once or twice till quite clean and of good colour; swill each time in water. Finish by rapidly dipping, cold, in a portion of the aquafortis that has not been previously used. Swill quickly in running water; then dip in clean hot water, and dry out in box or beech sawdust. Do not let the acid get on the clothes, as it will spoil them. A hard steel burnisher should be used to burnish prominent parts. Ox gall, beer, or soapsuds is used to lubricate the burnisher. When burnished to satisfaction, swill in clean hot water with a pinch of cream of tartar added to prevent rapid oxidation; dry out in sawdust as before, then lacquer. A burnisher can be made from an old square 10-in. file by softening it and filing the teeth off, then polishing, hardening, and again polishing. The section of the burnisher is elliptical.

Colouring Illumination Lamps.—The simplest and probably the best method is to use coloured lacquers such as are sold by the Fredk. Crane Chemical Company. The lamps should be thoroughly dried, and the lacquer either poured into them and then drained, or applied (inside or out) with a flat brush. When buying the colours, see that they are sufficiently dark for the purpose, as the lacquer dries considerably lighter than it will appear in bulk. Or proceed as follows: Cleanse the lamps with a strong solution of potash, well rinse in clean water, thoroughly dry, and place in a warm room for a few hours before colouring to prevent chilling. Obtain from the Fredk. Crane Chemical Company small quantities of cold lacquer of the colours required, and either dip the lamps and drain or lay the lacquer on with a camel-hair brush, the latter method being the better if only a few dozen lamps are to be coloured. Then hang them up to dry in a warm room. Common tumblers will answer the purpose of the lamps. They only need lacquering two-thirds up from the bottom, and about a tablespoonful of water should be put in

when using to prevent damage to the tumbler. The lacquer can be removed with strong soda water. Price's special bucket lamp candles may be used on account of their cleanliness.

Combustion in Oil Lamp.—The ordinary oil lamp is one of the best illustrations of perfect combustion and consequent smoke prevention. The heated gases rising in the chimney produce a draught, and fresh air is continually drawn in at the bottom through the hot gauze, which warms and divides it so as to ensure thoroughly mixing with the gases from the burning oil. Turn up the wick and the flame becomes smoky —too much hydrocarbon for the air supply. Raise the chimney slightly from the bottom and again there is smoke—too much air at too low a temperature which chills the flame. Insert a cool metal rod into the chimney and soot is deposited on it—chilling of the flame again and disengagement of the carbon, while the hydrogen continues to burn. And thus the three requisites for good combustion can be learned: enough air, a sustained high temperature, and a thorough mixing of the gases. The last two are so important that it is entirely possible to have an excessive supply of air and dense black smoke at the same time.

Dents in Metal Reservoir.—The dents and bruises can only be removed by hammering smooth over a bright stake, or by skimming over in a lathe. The vessel can then be polished in the usual way with flour emery powder and crocus, and finished off with the cotton dolly. It may then be lacquered.

Fire Risks with Paraffin Lamps.—Prof. Vivian B. Lewes says that if it were possible to prevent the sale of cheap and dangerous oil lamps, and one could at the same time do away with the side feeds and glass reservoirs, probably half the total number of fires and accidents caused by oil lamps would disappear. If people could be persuaded to keep a lighted lamp on a firm table and never to move it, another large diminution in the trouble would take place. The use of lamps with a proper extinguishing device, or if this is absent the putting out of the lamp by puffing across the top of the chimney when the lamp has been turned down a little, instead of blowing down the chimney, would further diminish the risk of accidents to a point where they would not be much greater than with other illuminants. If a properly constructed lamp with a soft, well-fitting wick is filled full each day so that it is never allowed to burn too low, the oil lamp is a most excellent form of illumination where coal gas is not available.

Improving Light of Paraffin Oil Lamps.—The placing of salt and camphor in lamp oil is of no practical benefit. Use good oil. The wick, which should be of a loose texture, fitting the wick-tube moderately loosely, should be renewed occasionally; make sure that the wick is dry before it touches the oil. Also clear all air passages in the burner; any wire gauze or perforated metal must be cleaned by brushing, not by merely washing. The above are the essentials for obtaining a good light. Combustion is then perfect, a much whiter and more dazzling flame is obtained, and there is no smoke or smell. Of course, the lamp must have its own proper shape of chimney. There is a general impression that when naphthalene (the so-called "Albo-carbon") is put into paraffin oil, the flame obtained is whiter and more brilliant than when paraffin oil alone is burned. A warning in connection with the use of this substance is: Do not put the albo-carbon into the lamps, but into the can in which the oil is kept, or should the lamp burn low of oil through neglect, the warmth will vaporise the carbon, and it will cause a series of small explosions, accompanied with dense smoke, and a thick, black deposit in the lamp glass.

Motor-car Lamps (*see* Acetylene).

Removing Collars or Rims from Glass Reservoirs.—(1) Tap the collar all round with a piece of hard wood, holding the reservoir in the hand the while. (2) If that does not loosen it, rub the edge of a table knife all round between the bottom edge of the collar and the reservoir, and then, using the edges of two knives as levers, try to prise the collar off. If that fails, it is very probable that there is some projecting flange on the reservoir which will hold the collar on until the plaster is crumbled. (3) Fix the ring in a vice having lead jaws, and work the body back-

wards and forwards until the cement is broken. (4) The following information is useful in this connection, but applies particularly to removing brass collars from the necks of glass retorts. If it is wished to preserve the collars, allow them to stand for some time in dilute hydrochloric acid, which will dissolve out the plaster-of-Paris. If the collars are not required, place them in strong nitric acid, which will dissolve the brass. Another method is to make file marks just above the collars, heat a piece of brass rod or thick iron wire in the blowpipe flame, and place it on the file marks. Often a crack will go right round at once; if not, the crack can usually be obtained after two or three heatings in this way. (*See also* "Glass Bottles.")

Renovating Copper and Iron Lamp.—The lamp bracket must be taken to pieces, and the copper parts tied together and boiled for about twenty minutes to remove all the old lacquer, in a boiling solution composed of ½ lb. of caustic potash and 1 gallon of water. Well swill in several changes of clean water, and dry in warm sawdust. The parts must then be polished, and afterwards lacquered, either hot or cold. The iron parts must be smoothed down, and may then be painted with cycle enamel if a polished surface is required. If a dull black finish is desired, after removing thoroughly all grease and dirt, the ironwork may be painted with, or dipped into, a solution consisting of 1 part bismuth chloride, 2 parts mercury bichloride, 1 part copper chloride, 6 parts hydrochloric acid, 5 parts alcohol, and 50 parts water, well stirred together. When dry, place in boiling water, and keep boiling for half an hour. Should the colour not be dark or black enough, repeat the operation. The black is fixed by coating with boiling oil and heating till all oil is driven off.

Laundry Blue (*see* Blue)

Lavatory Basin, Drilling Holes in (*see* Basin)

Lawn-mowers

For sharpening lawn-mowers, remove the wheels, take the left- or right-hand driving pinion and change it to the opposite side with the pawl properly in place, and then the knives will revolve backwards upon turning the wheel. A little emery and oil, a couple of twists of a screwdriver to adjust the stationary blade, and ten to twenty minutes' hand-turning with anything in the form of a handle fastened to the wheel will usually sharpen a mower whose blades are not very blunt. Of course, foot power of any kind where the belt could be run over the wheel will increase the efficiency several hundred per cent.

Lead

Lead (chemical symbol Pb, melting point 612° F., specific gravity 11·4) is a bluish grey metal which is lustrous when freshly cut. Being very malleable, ductile, and tough, it is used largely in many of the crafts. It is devoid of elasticity, very soft, and can be cold-welded by pressure. Lead is not affected by most acids, but moisture and nitric acid rapidly oxidise it. If it is slowly cooled from its melting point, it crystallises into octahedrons. Sheet-lead is of two kinds, cast and rolled, the latter being known as milled; and it is jointed, when occasion requires, in one of two ways, soldering or "burning." Lead is easily fused, and enters into the composition of many useful alloys, some of which are solders. It occurs in the form of ore, and generally as sulphide of lead, known commercially as galena, which is reduced as follows: It is first picked, then broken and washed, most of the mechanical impurities being removed. The ore then is partially roasted or calcined for two hours in a reverberatory furnace; lime is thrown into the furnace during the latter stages of the process, at the end of which the molten lead is run off and the slag is removed.

Hardening Lead.—Lead can be rendered hard by alloying it with antimony in proportions varying from 10 to 33 per cent. For ordinary purposes, 4 parts of lead to 1 part of antimony would form a suitable alloy.

Lead Pipes, Tinning (*see* Tinning).

Lead Wool.—Blei-wolle or lead wool has been introduced as a substitute for melted lead in making joints in spigot pipes. The blei-wolle is lead which has been shredded

to about the size of heavy thread, collected into bundles of convenient length and of a size in proportion to the joint to be filled, twisted somewhat and caulked cold into the joint against a backing of hemp or tarred yarn as usual. The material is produced by Aug. Buhne and Co., of Freiburg, Germany, and the invention is said to be protected by forty-three patents in all civilised countries. The term "wool" does not describe the material properly, as it really consists of threads as stated. It is cut from lead by special machinery, and is marketed in strands about 3 ft. long and weighing about 1 lb. each. The idea seems to be to obtain a spongy joint which shall fill the space close up to the confining surfaces and touch the whole surface. It is explained that lead contracts on cooling from its molten condition when poured into the joint, leaving a space between itself and the pipe, and that caulking but spreads the outer portion of this lead, leaving the inner part free to leak. It is claimed that the yarn in the joint is not compressed sufficiently in the melted lead joint, but that in the lead-wool joint the strands of lead are packed as they are put in, thus keeping the yarn under compression and filling the joint perfectly full of lead for its entire depth. A strand of lead wool is inserted in precisely the same way as the yarn and is caulked with the three caulking tools in order. These tools are dull pointed, having **V**-shaped ends which tend to spread the lead against the pipe. Then another layer is inserted, caulked, and so on until the joint is filled. The caulker solidifies the lead and, it is stated, leaves it free to adjust itself, so that when the joint is deflected, the lead and yarn adjust themselves and still fill the space.

Separating Lead from Ashes.—To separate the lead from ashes on a small scale is not a profitable undertaking. If the ashes are rich in lead, a considerable quantity of it can be obtained from them by mixing with ground charcoal, and then melting the lead at a low temperature. If the ashes are made too hot, any lead which may be melted will run to the bottom of the melting pot, and, owing to a too high temperature, be reconverted to dross. Dry powdered lime can be used instead of the charcoal. In any case, only a portion of the lead will be abstracted. A reverberatory furnace, in which the heat passes over the ashes, is better for the purpose than an ordinary melting pot.

Leather

Basil.—This is made by tanning the larger and stouter kinds of sheepskins with oak and larch bark. This leather is generally used in the best class shoe trade only for pump inner soles.

Black Bag, Renovating.—If the bag is made from a black, dull sheepskin, first wash it with a sponge and warm water to remove all dirt and grease. Then with a sponge saturate the leather with black dye, obtainable from a grindery shop; when dry, wipe over with an oily rag. Treat the surface carefully, or the face of the leather will peel off. If the bag is of black morocco, wash and dye as before, but instead of using oil, procure some Empire gloss, made by Livingstone and Doughty, of Leicester; place a small portion on a boot brush, and rub the leather briskly. If the bag is of black polished morocco or hide, wash and dye as before, and when the leather is dry warm it, and with a dry sponge or brush apply lightly some leather varnish.

Black Grain (Cow) Hide.—This is treated somewhat as waxed calf (*see* p. 338), but the dyeing is done on the grain side, and as much stuffing is put in as it will possibly hold.

Blackening Brown Bags.—The following instructions apply to the blackening of a brown leather bag that has been saturated with oil. To remove the oil, brush the bag all over with a solution made as follows:—Procure a lump of common soda about the size of an egg, crush it small, and place in 1 pt. of boiling water; allow to cool, then well stir. About two hours after the first application, give another brushing; this will disperse the oil, so that the bag will be fit to receive the coat of black. Get two pennyworth of shoemaker's ink at a leather-cutter's, and give the bag two coats, applied with a brush. When

quite dry, rub with a dry cloth, and then apply, with a small sponge, the white liquid part of an egg. The bag will then look like new. When a brown bag has been so spoiled in appearance that its colour cannot be restored, it is better to blacken it, as described above.

Boot Leather.—To judge a piece of good leather that will stand hard wear, first be sure that it is English. Foreign leather, English tanned, may wear very well. The grain or face of the leather should be a nice pale nut-brown, and, if properly made, quite smooth. To a novice, almost any piece of leather seems good until it is worn, and so long as it feels hard or will not readily bend between the two hands he does not know how to recognise faults. If the instructions given below are followed, the good can be picked out from the bad almost at a glance. Fig. 420 is a piece of leather cut straight through; A is the grain (epidermis), B the portion (dermis) for wear, while C is the side which comes off the animal, and is termed the flesh side. Fig. 421 is a similar piece, A, B, and C denoting the same portions, the difference between the two being that Fig. 420 is a bad piece of leather, while Fig. 421 shows a good piece. Now, in buying a pair of half-soles, look at the edges. If the grain is coarse and deep, as A (Fig. 420), do not take them. If the portion at B is streaky, loose, or long-grained in a direction from B to B, reject it, and do the same thing if there is a layer of any matter on the flesh side, as at C, for all these are bad properties. To be good, the flesh side should be well fleshed, and should have a smooth mottled or dull brown surface, as Fig. 422, and if any veins are seen on it, as A, A, A, it is a sign that it has been well fleshed, otherwise they could not be seen. It should smell a little sour to be pure oak-tanned, and when cut with a good sharp knife the portion cut should be somewhat polished by the operation. If the thumb-nail is drawn down the edge of the grain, from A to A (Fig. 420), it will be found to be almost like a saw, and unyielding; but if passed over the same place at Fig. 421 it will feel to the touch like velvet. It will also be seen by this illustration that while the grain A is very thin, it is light in colour, and that the nearer to the flesh the denser the dermis gets.

Box Calf.—This is believed to be produced by chrome tanning. It is somewhat like firm ooze calf, only black, but resists moisture better. There is a green calf leather, also an iron calf or kid, which is much like calf kid, but, from being dressed to resemble kid, is very useful, and extremely strong.

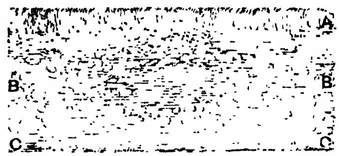


Fig. 420. Section of Inferior Leather.

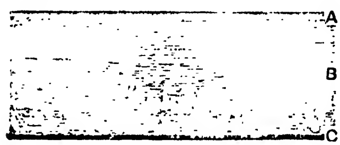


Fig. 421.—Section of Superior Leather.

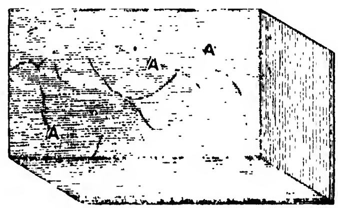


Fig. 422.—Flesh Side of Leather.

Bronzing Leather (*see* Bronzing).

Brown Cowhide.—This is worked in the same way as black grain cowhide, but it is very slightly stuffed in cases where the natural colour is not needed and dyeing has to be resorted to.

Brown Glacé Kid.—This is produced, it is believed, by chrome tanning. Brown glacé kid is an American production, and seems to vary much as regards retaining its colour in wear, according to the shade given it; the bright browns last well, while the dull or subdued tints sometimes change under the influence of cream dressings.

Brown Levant Morocco.—This is the same as morocco Levant, except that it is made from younger and smaller skins, and is more finely grained.

Brown Persian.—This is obtained, as a rule, from Cape sheep, and makes a fine, soft, tough leather. When dyed it resembles morocco, but is left with a smooth grain.

Buckskin.—To prepare this leather for use, the whole of the grain is cut away and oil is hammered into it, any excess of oil being removed afterwards. A vast amount of working is necessary to give it suppleness. Doe is similar, but not so good.

Calf Kid.—This is a most useful leather made by tawing, not tanning. It has to pass through the following routine: Soaking, cleaning, liming, unhairing, fleshing, paring, scudding, drenching, alum and salt dressing, drying, seasoning, staking, shaving, egging, dyeing, and finishing. The difference between tanning and tawing is briefly this: When tanned, the greatest component part of a skin, namely, gelatine, is, by the action of tannic acid, formed into leather, of which these two ingredients are the chief factors. The acid arrests decomposition, and the two ingredients cannot return to their former state; whereas, in tawing, alum, salt, and gelatine form the leather, and, although the two former prevent decomposition of the gelatine, each ingredient can be brought back to its original state.

Cement for Leather.—(1) A simple solution of guttapercha in bisulphide of carbon answers the purpose. (2) Another cheap cement for leather may be made by melting together 16 parts of guttapercha, 4 parts of pure indiarubber, 2 parts of yellow pitch, 1 part of shellac, and 2 parts of linseed oil. (3) Soak equal parts of glue and isinglass in water for ten hours, pour off the water, and then gradually melt the materials by slowly heating, stirring in some tannic acid until the mass becomes ropy and coagulates like the white of an egg. To use the cement, spread a layer hot on the pieces of leather, stick them together, and put the leather under pressure till dry. Rough the leather if the surface is smooth, and remove any grease before joining the parts. (4) India-rubber solution can be applied as follows: Dip an ordinary nail-brush into the solution, spread it evenly over the two pieces of leather and let them stand for about an hour. Then join them and roll the sur face of the leather with a wood roller till the solution sets firmly.

Cementing Leather to Iron.—(1) The iron should be roughened by filing, then heated and rubbed with a piece of marine glue or tyre cement, and while this is tacky the leather should be pressed on. The cement is quite impervious to water and will stand slight heat. (2) First paint the iron with lead colour, such as white-lead and lampblack. Soak glue in cold water until it is soft, then dissolve it in vinegar at a gentle heat, add one-third of its bulk of white turpentine, mix thoroughly, and apply hot to the painted iron. Apply the leather quickly, and press tightly in place. Probably, No. 1 recipe is to be preferred.

Chamois.—This is described under the main heading, "Chamois Leather." (*See* p. 125.)

Cleaning Tan Leather Breeches.—To clean tan-coloured breeches, mix together equal parts of yellow ochre, brown umber, and light carbonate of magnesia; incorporate these with petroleum ether to form a thin paste. Lay the breeches on a table, and brush them well with the above preparation, which should be laid on plentifully. Now hang the breeches in the open air to dry, then brush out all the powder with a stiff brush. Finish by rubbing with yolk of egg or brown boot polish, applied on a rag. A solution of oxalic acid is also used for cleaning.

Cleaning White Leather Breeches.—White leather breeches will be somewhat difficult to clean, especially if they are much worn. Try a mixture of benzoline and light magnesia; the magnesia can afterwards be brushed out. In cleaning leather, the only drawback to the use of benzoline is the fact that it dissolves the oil out of the leather and renders it dry. To remedy this, the leather should be worked about with the hands and a very little oil rubbed in at the back. If the leather is whitened by a superficial coating, it would not be necessary to clean it in this way; it should

be cleaned with breeches paste, obtainable from London blacking makers.

Cordovan.—This is made in many places other than its supposed place of origin—Cordova. It is tanned and curried on the grain side, and passes through some special processes, such as a bran bath and a fig bath. It is made a good deal from horse, goat, and even dog skin. An inferior leather, much like it, called "grain," is used a good deal for cheaper work, and a much newer production, called "satinhide," is a similar leather, but possesses a smoother face. Cordovan stands easily first for durability, satinhide being next.

Cowhide Patent, Enamel Hide, or Diamond Hide.—This is made from the hide of the cow. The process of enamelling is the same as that for patent calf, except that the enamelling is done upon the grain side after the grain has been printed or otherwise prepared. It is now produced with a smaller grain than in former years, when it had a longer grain like the leather now used for bags, etc.

Cream Roan.—This is made generally from good (medium weight) sheepskins, sumach tanned, and is similar in structure to morocco, though, like all sheepskin, it is less durable.

Crup or Horse.—This is taken generally from the butt of the horseskin. It is practically the middle part of the skin that is dressed for this leather, as the grain and a good quantity of flesh are taken off. When good it wears well and is waterproof, and polishes more easily and better than calf. Its uses are the same as those of waxed calf.

Dyeing Leather Black.—Leather is dyed either by rubbing on the dyes or by immersion, but the former method will serve most purposes. Make two solutions, one by boiling 4 lb. of logwood chips with 1 gal. of water and straining; then add to this a little carbonate of soda. The other solution is made by dissolving 8 oz. of sulphate of iron (copperas) and 1 oz. of sulphate of copper in 1 gal. of water. Having both solutions warm, brush the logwood solution well into the leather, and after about a quarter of an hour follow with the iron solution; allow the leather to dry partly, and, if the black is not continuous, brush again with both solutions. Rub up a little soap with water and add a little egg yolk; put this on the leather, and rub well in. Dry the leather slowly and stretch it on a board from time to time, rubbing with a smooth piece of wood to obtain a firm and even surface.

Glacé or French Kid.—This is a very delicate and fine-surfaced leather. It is subjected to a process of tawing which imparts to it great suppleness. It is dyed upon the grain side, except when bath dyed, which is rarely the case, and is then glazed and polished.

Glove Kid.—This is made into leather by tawing in the same way as calf kid (described on p. 334), but its character and uses are quite different.

Hide.—The commercial divisions of a hide or skin of leather are the cheeks, shoulder, shanks, belly, and butt. The last named, which contains the best parts of the leather, is included in what is practically a rectangle, drawn from the outer angles where the four shanks, or legs, join the body. The belly part consists of two long, narrow pieces, one on each side; while the terms cheeks and shoulder are self-explanatory.

Kangaroo.—The skin of the kangaroo, when properly tanned, does not crack. It is one of the softest and prettiest leathers, and has been greatly improved in recent years.

Long-grain Morocco.—This, like morocco and brown Levant morocco, is made from the skins of goats, but has a long grain running across the skin. These leathers are tanned with sumach, provided by leaves and twigs. The better kinds are the Strasburg moroccos.

Memel Calf.—With few exceptions this is treated in the same way as waxed calf. In some cases the whole skin is treated; but in a great many instances it is only the shoulders, or perhaps the necks, that are made into Memel. It should be well tanned. The compoing is done on the grain side, and the stuffing on the flesh side, and not so much of either is needed as for waxed calf. It is grained with a roller according to the sort of grain required, whether pebble, long, etc. After oiling,

sizing, and drying, the graining is finished, the leather is finely oiled, and is then ready for use.

Morocco or Levant.—This is a beautifully grained and tanned goat-skin, dyed on the grain side, and finished with a bright pebble grain. A cheaper and somewhat greasy kind is not nearly so good-looking or durable in wear as the dry-dressed morocco Levant, which has a beautiful soft brightness. Skins are produced in imitation of moroccos of various colours. These are called roans, and are made from sheep-skins, as "Cream Roan" (*see* p. 335).

Ooze Calf.—This is a very soft leather in wear, and most durable if kept well cleaned. It has a nice pebble grain, which generally forms the face. The flesh side is a velvet pile; this when first produced was considered the right side, and it was so made up and advertised as "velvet calf." But the grain is the side now generally preferred.

Patent Calf.—In making this leather, the skin, having received its preliminary preparation, is stretched upon a smooth board, and every particle of grease extracted from it with fuller's-earth and water. It is then given four coats of varnish containing drying oil, vegetable black, and Prussian blue. As each coat is applied, the leather is stoved and afterwards polished with powdered pumice-stone. The final coat has an addition of darker Prussian blue, and sometimes a little copal or amber varnish. The stove heat varies from 120° to 180° F., according to the leather under treatment.

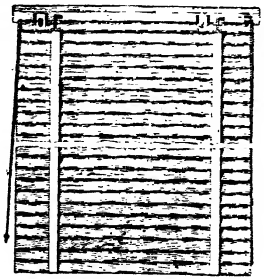
Patent Leather.—It is possible, but difficult, for an amateur to prepare patent leather. The skin is prepared in a dry form, more as a russet, and grease must not come in contact with it. While wet it is stretched on a slab, grain side down; during drying it shrinks and toughens. With suitable implements, three or four coats of drying varnish are worked into the leather; this varnish is made by boiling 1 gal. of linseed oil with 1 lb. each of white-lead and litharge, and adding a portion of chalk or ochre; each coating must be thoroughly dry before the next is applied. Ivory black is then substituted for the chalk or ochre, the varnish thinned with spirit of turpentine, and five more coats are put on thin, not worked in. The leather is next rubbed down with pumice powder, and placed in a room kept at 90° F. well out of the way of all dust. The finishing varnish is prepared by boiling ½ lb. of asphaltum with 10 lb. of the drying oil used in the first stage of the process, and then stirring in 5 lb. of copal varnish and 10 lb. of turpentine. Patent leather is not good till it has been kept at least a month or six weeks; nor should it be kept too long. When finished and set, two skins are put together, face to face, and all air is excluded from between them by rubbing the top one well on the bottom one; then they are rolled up together for packing, the air being kept from them as much as possible. Before separating them, they are warmed gently to prevent cracking.

Patent Leather, Cracks in.—The best method of treating a pair of patent leather shoes that have cracked all along the top, is to procure a shoemaker's soft heelball (cost, ½d.), warm the leather a little, and while there is something hard underneath, briskly rub the heelball into the cracks; then well rub with a piece of old cloth till the whole of the leather is bright and smooth. If the rubbing can be done on boot trees, so much the better. If the polish is not bright enough, give a coat of stale white of egg, or a very thin coat of patent leather varnish; or if the shoes are very old, a coat of Nubian blacking might be applied; but as the latter is apt to render the leather hard, it is not wise to use it on good shoes.

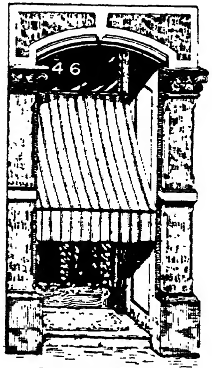
Patent Leather, French Paste for.—This can be made by adding olive oil and lard to some wax previously melted on a water-bath. Thoroughly mix, and add oil of turpentine and a little oil of lavender. Keep the paste in boxes, and apply with a linen rag.

Patent Leather, Reviving.—To restore the appearance of patent leather, apply lightly a mixture made in the proportion of 2 oz. of paraffin, ¼ dr. of oil of lavender, ¼ dr. of citrionel essence, and ½ oz. of spirit of ammonia.

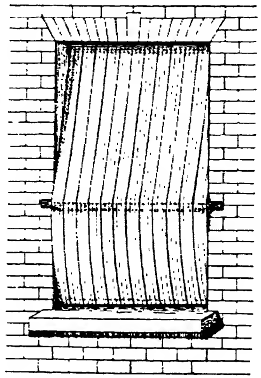
Pigskin.—Generally this is dressed brown. It is a tanned leather, light in weight, porous, very durable, and soft and cool to wear.



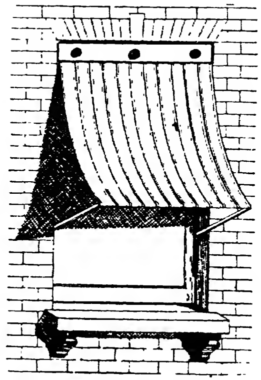
General View of Venetian Blind when Hung.



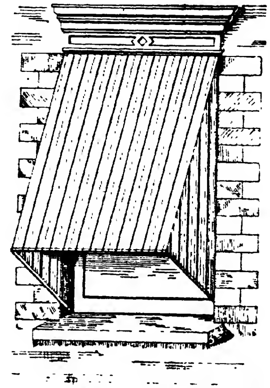
Outside Sun Blind for Front Door.



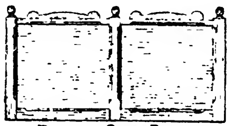
Outside Sun Blind for Window.



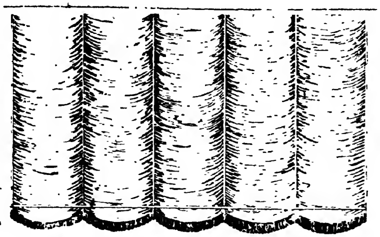
Permanent Sun Blind for Window.



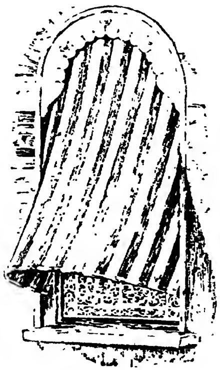
Florentine Sun Blind



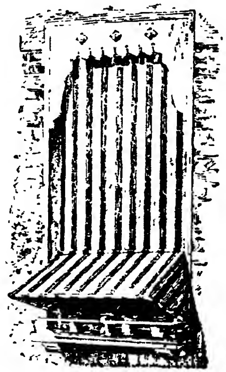
Two Part Glass Blind



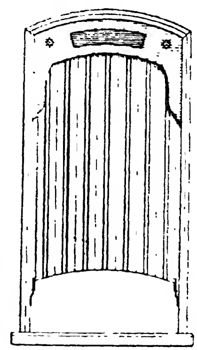
Festoon Blind showing Lath and Gathers.



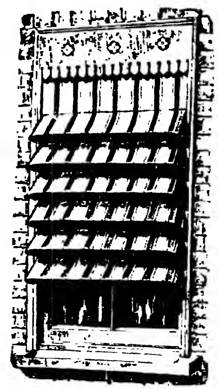
Oriental Blind



Spanish Blind.



Florentine Blind with Curved Top Rail.



Heliosene Blind.

WINDOW BLINDS.

Porpoise-hide.—This is tanned and very greasily dressed, and makes a very soft and waterproof leather. It is expensive, but is exceedingly durable.

Removing Ink Stains from Brown Leather.—Make a solution of 1 part of oxalic acid in 10 parts of water; touch the stain with this until it is removed, then wash off with water, dry, and rub up with a little brown leather polish. There is no way of removing ink stains from brown leather without leaving a lighter shade at that particular place. In the trade, the method usually adopted, if ink stains should get on the leather, is to cover the stains with oxalic acid and then re-colour the whole of the leather with saffron and annatto, which must be a deeper dye than the original.

Removing Mildew Stains from Leather.—Well rub the leather all over with spirit of ammonia; this no doubt will remove the stain and revive the colour. Well soaking the leather on the grain side with spirit of ammonia, afterwards well rubbing with a soft dry cloth, and leaving to dry under pressure, will in all probability make the leather as stiff as desired.

Renovating Faded Green Furniture Leather.—Remove all grease and dirt from the leather by washing with warm water and soda with a large spoonful of ammonia added. Now take 1 oz. of powdered borax and 2 oz. of bleached shellac, add this to 1 pt. of hot water, and let it stand in a warm place until the lac dissolves. This will take about twenty-four hours. Then strain through a piece of cotton. Now place in the warm solution a packet of olive-green diamond dye; mix thoroughly together, and add a teaspoonful of glycerine. Apply this to the leather with a swab of soft rags or a sponge, rubbing well into the faded portions. When dry, wipe with skim milk.

Renovating Red Leather Dining-room Suite.—The faded portions can be stained, but the joins will be more or less apparent. Patch-dyeing is seldom successful. If the leather is of good quality, and is in fair condition as regards being worn, the covers should be taken off and sent to a leather dyer. New buttons, banding, and studs can then be put on with the leather, and its appearance will be equal to new. If it is decided to dye the faded portions alone, wash all the leather with warm water and ammonia. For purple-red leather, boil 1 oz. of cochineal in a pint of water with a teaspoonful of powdered alum for half an hour. Experiment on a piece of waste leather and see how the colour dries; if it dries too decided a red, add a drop of common writing ink until the stain is fairly matched; this will dry darker than it looks when wet. Sponge over the faded portions and allow to dry. The natural gloss of the leather is obtained by friction, such as by burnishing, but this is not possible with furniture leather in position, therefore a varnish or glair must be used; equal quantities of clear gum and white of egg sponged over is as good as anything. A varnish finish is not desirable, and shellac mediums harden and crack the leather. An alternative method of renovating would be to give the whole surface of the leather a black dressing, which can be obtained at leather stores. The colour would then be uniform, and would lose very little in texture and be smooth and hard when dry. A new line of gilt-edged leather banding run round the borders would liven up the sombre appearance of the black leather. Another method of renovating a purple-red leather dining-room suite is as follows: The covers, which need not be taken off, must first have all dirt and grease removed, either with warm weak soda-and-water, ammonia-and-water, benzoline, or petrol—one of the last two for preference. Then make a solution of 2 oz. of gum arabic in 1 pt. of boiling water, and when this is cold and the skins are dry, thoroughly saturate them with this size, using either a sponge or a bristle brush. To dye the skins, obtain some liquid archil, which will probably require weakening with water, and when the size is dry, dye the skins all over with this preparation. Should any parts be lighter in colour than others, some of the strong stain must be sponged on them whilst the covers are still wet. Skins of any colour can be dyed by using aniline dyes which are soluble in water. When the stain is quite dry, a gloss can be obtained

by varnishing with the well-beaten whites of about six eggs, this giving a dull shine; for a brighter gloss, use a mixture of 1 part of button polish and 2 parts of methylated spirit. These varnishes leave a soft smooth surface which will not crack. Should the faded portions be very much perished, it may be advisable to give them two or more coats of the size. Varnishes or so-called leather revivers must not be used, as they cause the surface to peel and rot the skins.

Russet Calf.—This is used either dry or with a little oil dressing; in the former case it is very pale, the oil making it a little darker. Horse and other animal belly rounding is now often dressed in a like manner. Its preparation is similar in some respects to that of other dry-dressed leathers, and, among other processes, it passes through a solution of borax, weak sulphuric acid, and a warm bath of Sicily sumach and alum, which forms a mordant when further dyeing is needed.

Russia Leather.—This is one of the best of brown leathers. In dressing this leather, it is first freed from hair, rinsed, fulled for a longer or shorter time according to the nature of the skin, and fermented in a proper steep, for a week at least, after a hot-water washing. It is then worked on the beam after soaking for forty-eight hours in a bath containing a fermented paste of rye flour. It is rinsed for fifteen days, then worked in the river, and subjected to the stringent juices of willow bark, etc. After much working in this, it is set to dry and curried with empyreumatic oil of the bark of birch tree. To this substance the Russia leather owes its peculiarities. If the oil passes through, it stains the grain side. The red colour is supposed to be from sandalwood or basil wood.

Skivers, Brown, etc.—This is the grain of sheep-skin split by machinery (the flesh side being prepared for chamois or wash-leather). In appearance it is much like brown Persian, except that it is extremely thin. This is really bookbinders' skiver, and is used for covering fancy articles.

Tan Calf.—This has been produced to imitate Russia leather at less cost, and there now is a greater quantity used for the best class of work than of real Russia. Each season brings its varied and improved shades. The calf skin is such a ready recipient of dyes, that by manipulating with various mordants the expert leather dyer can produce some very delicate tints.

Waxed Calf.—After depilation (de-hairing) and tanning, the skin passes through a variety of processes, namely, soaking, fleshing and skiving, graining, finishing, stretching, stuffing, compoing, drying, whitening, blacking, sizing, polishing, etc. This will give some idea of the amount of handling a calf-skin goes through before it is converted to leather. French calf-skins, especially "females," are the best, and softest in wear, although those of English production are, in some cases, very fine; the latter, not being so soft, are found suitable for stronger and heavier work than French.

Welting.—This is generally made from English shoulders, which are converted into welting by being stuffed well with grease. They are used for the welts of hand-sewn boots and shoes.

White Sheep.—This is a tawed leather, and is a very soft material. Among the many processes it undergoes is the application of paste composed of flour and yolks of eggs, in addition to the alum bath which it has previously received.

Willow Calf.—This is similar to box calf, but it is of a brown colour. It is believed to be produced by chrome tanning. It is made in good colours and retains them longer, perhaps, than any other sort of brown leather, and is easy to clean and repolish. It is used for all purposes for which box calf is employed.

Leaves

Bleaching Green Leaves. — To bleach green leaves, place 1 oz. of so-called calcium hypochlorite ("bleaching powder" or commercial "chloride of lime") in 1 pt. of rain or distilled water contained in a flat dish. Liberate the chlorine by adding acetic acid and place the leaves in the liquid, seeing that they do not overlap each other; then cover the dish to confine

the gas. In ten minutes the more delicate leaves will be bleached, a longer time being required for the thicker ones. Remove the bleached leaves by slipping under them a piece of card, and then float them in a basin of fresh, clean water. After a time change the water and allow the leaves to remain until the chlorine odour disappears. Then place them between blotting-paper to dry. Sodium hypochlorite may be used instead of calcium hypochlorite; for some things it is better, since it does not destroy the tissues as bleaching powder and acid do. These, however, are preferable for hard materials and for those that are very dark coloured. They are used for removing the colouring matters from plant sections before these are mounted for microscopic examination.

Dyeing Maidenhair Fern.—The best dye for producing the effect of natural preservation is that known as chlorophyll green, which is, indeed, the green colouring matter of plants, and is extracted from plants by chemical methods. The chlorophyll should be dissolved in methylated spirit (forming a strong solution), the fern dipped in the solution, allowed to dry, and then pressed between paper under a weight. There are three commercial varieties of chlorophyll, and they are soluble in oils, in spirit, and in water respectively. The kind that is soluble in spirit should be obtained.

Skeletonising Leaves.—Take a jar of rain water (an ordinary flower-pot with a cork in the bottom will do very well), and drop into it a few broken pieces of cabbage leaf. On top of the cabbage put the leaves it is wished to skeletonise, with a few more pieces of cabbage leaves on top of them. The cabbage leaves act as yeast, the object being to set up as quick a fermentation as possible, and everybody knows the quickness with which a cabbage leaf will make itself objectionable. Add a little rain water, cover the pot to keep out the insects, and put in a dry place to ferment and putrefy. The leaves in process of maceration will make an objectionable smell, so the pot had better be put in a shed out of the rain and where the sun can get at it, if possible, but on no account must it be caught by the frost; the water should not drain away or evaporate, and no fresh water should be added. Let the leaves remain for a month at least, and then try them. With a flat stick of wood or the hand take out some of the rotten cabbage at the top, then take up the leaves one by one; if they are nice and pulpy, put them in warm water and gently rub them between thumb and finger to clear away the loose stuff from the surface; if the pulp does not come away easily, do not force it, but try what a camel-hair brush can do. If there are some which cannot be cleaned properly, do not put them back into the old water; put clean rain water and cabbage leaf in the jar or pot, and carefully lay the unfinished leaves, one on the other, in it, with a cabbage leaf on the top; set aside, and in a fortnight try again. The leaves that have been skeletonised should be put into a jar of clear cold water for a day or two; they require the very gentlest handling; it is impossible to avoid spoiling a few, and the stems are almost sure to come off. To dry the leaves, make two smooth pads of any soft material, press each leaf slowly and gently, and dry it thoroughly. There are other processes which smell less and are quicker, but they require more care. Do not complain if only one perfect leaf is obtained from every dozen to begin with. To bleach them, get ½ lb. of chloride of lime, put it in a jar, add to it 1½ pt. of clean rain water, and mash it well so as to leave no lumps in it. Put it by for about an hour in a cool place. By that time most of the lime will have settled to the bottom, but some will be floating on the top; skim off the top and throw it away, pour off the clear solution into a bottle, and throw away the deposit. Get a few pickle bottles, or any glass jars with wide mouths, stack the dry leaves into them carefully, but place the fine ones in one bottle and the coarse in another. Be sure to stack the leaves so that the stems point downwards; do not lay them flat one upon the other. Pour into each bottle a pint of water, and add to it two tablespoonsful of the chloride of lime solution. Some leaves will take twelve hours to bleach, some only six. When they are white, take them out and rinse them in warm water, rinsing them

again in cold water, and then dry them between blotting-paper. Finally, be prepared for a large percentage of failures, and, above all things, do not be in a hurry.

Leclanché Battery (*see* Electric Batteries)

Lenses (*see* Optical *and* Telescope)

Lime

Fat Lime or Rich Lime.—This is made from nearly pure carbonate of lime, calcined from the upper chalk, marble, or other beds, containing 98 to 100 per cent. carbonate of lime. It slakes fiercely, swelling to two or three times its original bulk, with great disengagement of heat and steam, and falls into a bulky powder which, made into mortar, has little setting power. It is very soluble and used chiefly for plastering and whitewashing. Rich lime will carry the most sand, because it is nearly pure carbonate of lime. The colour is creamy white or pale buff. Chalk lime, otherwise known as rich, fat, or pure lime, is used for plastering because it slakes readily and thoroughly; it is economical, the slaking process causing it to swell to two or three times its original bulk, and it works easily. It is deficient in strength, but strength is not required. It is porous, and therefore temporarily absorbs the moisture which condenses on a wall upon a sudden rise of temperature. It is cheap in the first instance. It does not spoil but rather improves by being mixed a considerable time before it is required for use; this is called cooling it.

Hydraulic Limes.—These are made from carbonate of lime containing a mixture of clay, which gives it the power of setting under water—hence the term hydraulic. They slake almost without heat, and do not fall into powder; they set vigorously even in damp situations, and do not require access of air. The colour is pale grey.

Lias Lime.—This generally contains from 20 to 30 per cent. of clay, and is difficult to slake. It sets firm under water in twenty hours, is hard in two to four days, very hard in a month, in six months can be worked like a hard limestone and has a similar fracture. It is liable to blow when used for plastering, and gives a non-absorbent surface.

Poor Lime.—A poor lime contains from 60 to 90 per cent. of carbonate of lime, together with useless inert impurities, slakes sluggishly and imperfectly, with little increase of bulk; it sets rather firmer than rich limes, owing to the presence of a small quantity of clay, but has no strength.

Quicklime.—This is freshly burnt chalk, or broken limestone, produced in a tunnel kiln or flare kiln (*see* the main heading Quicklime). When water is applied to fresh quicklime produced from soft white chalk it hisses, crackles, and explodes, gets very hot, sucks up the water quickly, produces large volumes of steam, and falls into a bulky powder.

Stone Lime or Grey Chalk Lime.—This slakes very freely; after being wetted it pauses a few minutes, then slakes with decrepitation, development of heat, cracking and ebullition of vapour. It will set in still water owing to its containing 5 to 12 per cent. of clay. It is suitable for making mortar for building ordinary walls of brick or stone; it is feebly hydraulic, and of a light buff colour.

Sulphate of Lime. (*See* Plaster-of-Paris.)

Limestone (*see* Quicklime)

Linen

Bleaching Grey Linen.—It is far more difficult to remove the colouring matter from linen than from cotton or wool, and, at the same time, a considerable amount of the fibre itself is removed, the loss amounting to 20 or even 30 per cent. of its weight. The linen is first boiled in milk of lime, then in hydrochloric acid or "sour," then in caustic soda lye twice, and exposed in a field for several days. It is next treated with a bleaching powder solution, followed by dilute sulphuric acid, and another boiling in caustic soda solution; it is again exposed in a field, and finished with a very weak bleaching powder solution.

Linen Polish.—A linen polish patented in Germany is prepared by agitating a mixture of white wax and carbonate of potash with water, an alcoholic solution of white tallow soap being added, and the whole

then being boiled. The polish is sponged on to the linen whilst ironing.

Preparing Linen for Writing Upon.—Unprepared linen is, of course, not suitable for writing upon, because, like blotting-paper, it is too absorbent. The linen must be highly sized, when it is to all intents a kind of paper, rustling exactly like it.

Removing Fruit Stains from Linen.—Steep the linen in a chloride of lime solution (about ½ lb. to 1 gal. of water), or preferably in hypochlorite of soda, which may be made by treating ½ lb. of chloride of lime with ½ gal. of water, dissolving ¾ lb. of washing soda in ½ gal. of water, and mixing the two solutions. The solution should be allowed to remain till clear, the liquid poured off from the deposit being used for bleaching.

Removing Ink Stains (*see* **Ink Stains**).

Removing Iron-mould from Linen.—A solution of salt of lemon (citric acid) placed on the iron-mould, allowed to remain for about half an hour and then washed out with clean water, will remove the discoloration. Dilute hydrochloric acid will also answer.

Linoleum (*see* Floor Covering)

Litharge or Massicot

Litharge or massicot is the monoxide of lead—PbO. This is generally prepared by heating the carbonate of lead to redness, common litharge being the product from the fusion of impure monoxide. It is heavy, slightly soluble in water, and crystallises from a solution in alcohol in prisms of rhombic form. It may be reduced by heating with most organic substances that contain hydrogen or carbon, and melts at a red heat, showing a tendency to crystallise on cooling. It forms a body of salts known generally as plumbic salts, and itself has a straw-yellow colour. When in a melted state it has enormous powers of attacking earthenware or siliceous materials. It occurs native in Mexico, and is largely employed as a glaze for earthenware, in the production of flint glass, and the manufacture of most of the preparations of lead, including red lead and white lead. Litharge as a paint drier may be had in the form of a reddish-yellow powder, consisting of lead and oxygen. Formerly it was ground finely in oil, either pure or mixed with white vitriol, and then added to the dark oil paints. But to-day, says a German master painter, speaking of German practice, litharge and sugar of lead (lead acetate) are used only exceptionally as driers, these having been displaced by the liquid manganese siccatives, which are easy to handle. The German authority is of the opinion that the neglect of the lead compounds has not been beneficial to decorative painting. Where they were used in suitable quantities, hard-drying coatings were obtained almost always, and there was less tacky paint and varnished work then than now.

Litmus Paper

Litmus may be obtained in the form of small blue cubes. To prepare ordinary litmus paper, powder 1 oz. of the litmus and boil it with 4 oz. of water, filter, and wash the residue with a little hot water, adding this to the filtrate. If blue litmus paper is required, cut blotting-paper into strips, dip them in the solution, and hang up to dry. If red litmus papers are required, add one or two drops of nitric acid (just sufficient to change the colour of the solution to red and no more) and dip unsized paper in this. For careful work the litmus must be purified before using. Acids or their fumes turn blue litmus paper red, it being, however, restored to its blue tint by alkalis. Litmus solutions are sometimes used instead of papers. White blotting-paper dyed in tincture of red cabbage, blue iris, corn cockle, or dark-purple dahlia, or in syrup of violets, is also a test for acids. The same kind of paper, dyed in a solution of turmeric, is useful as a test for alkalis, which convert the yellow tint to brown. These test papers should be kept in a box with a close-fitting cover to exclude light, dust, and fumes.

Lock Fitting

Locks for ordinary domestic work are of several kinds. Interior doors of a less thickness than 2 in. are usually fitted with a lock called a rim lock (Fig. 423), the mechanism of which is enclosed in an iron box, which is screwed on to the face of the door.

The box is usually made of cast iron, and japanned. Great improvements in the manufacture of rim locks were introduced about twenty years ago, the Anglo-American locks then adopted being of stronger

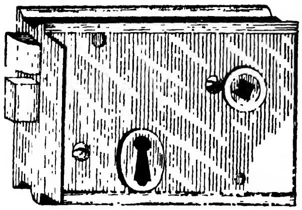


Fig. 423.—Rim Lock.

make, better in design and finish, and better japanned than were most English rim locks. The casting was clean and true, and the outer angles of the locks were rounded, thus presenting none of those sharp edges which formed such objectionable features in the old ordinary lock. By a simple contrivance inside the lock, the screws which fasten the plate on were not brought through to the surface. The mode of japanning by dipping the whole lock into the liquid japan, instead of painting it on with the brush, together with the much improved quality of the japan, greatly enhanced the appearance of the locks. In America it had been, and perhaps still is, the custom to devote very much more care and expense to the ornamentation of

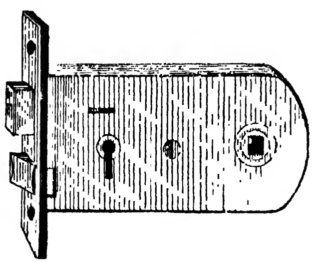


Fig. 424.—Mortice Lock.

rim locks than is the case in this country, the outer plates being frequently elaborate and beautiful pieces of metal-work even in inexpensive locks. When it is desirable to conceal the lock entirely, a mortice lock is used (*see* Fig. 424). The object to be aimed at in a mortice lock is compactness, so that the stile of the door shall not be unnecessarily cut into and weakened. This object was perhaps first successfully attained by a lock of American manufacture, in which the mechanism was arranged in so small a space that the mortice to receive it could easily be formed in the space between the tenons. The depth of these locks was only 1¼ in., and the thickness ⅝ in. An additional advantage was the simplification of the labour of fixing. The top and bottom edges being rounded, the mortice could be made by simply boring two holes with a centre-bit, and cutting away the space between them, the labour involved in making the mortice rectangular being entirely dispensed with. A useful idea which is carried out by some lockmakers is to affix a number to each key and also to the plate of the lock. A register is kept of all locks and their destination, so that a lost key

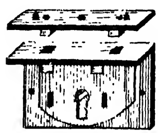


Fig. 425.

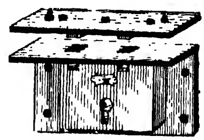


Fig. 426.

Figs. 425 and 426.—Box or Chest Locks.

can be readily replaced or an additional key obtained merely by forwarding the number to the maker. It will be obvious also that such a system of numbering would obviate much inconvenience resulting from mixing up the keys of a large establishment. Locks for front doors are nowadays commonly of small size, but are often of very excellent mechanism. One kind of lock for this purpose consists of a number of thin levers of brass or iron working side by side. Another kind is a solid bolt with a spring. Both kinds, when well made, are convenient and efficient. By an arrangement of small bolts acting on levers, these locks can be counter-locked, so that the key cannot be worked; they can also be held open when it is so desired.

Fitting Locks.—The handyman can fit many locks with but little trouble, and some simple jobs of this kind not in-

volving much cutting are described below. The work requires great care, as the appearance of valuable woodwork is easily marred by careless fitting.

Fitting Box or Chest Locks.—The box or chest lock (Figs. 425 and 426) is fixed

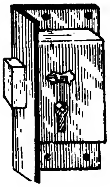


Fig. 427.

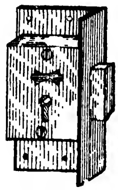


Fig. 428.

Figs. 427 and 428.—Cut Cupboard Locks.

in the same manner as a drawer lock (*see* p. 345), but a little care is required to fix the link-plate. To do this, lock the link-plate in and slam down the lid of the box sharply. Now unlock it, when the two pins will hold the link-plate in position on the lid, and on carefully opening the lid the link-plate will be found ready for marking round exactly over the place where it is to be let in. It is best to let the link-plate remain in the lock while it is cut in, or it may be found that, though space sufficient for the lock has been made, room has not been obtained for the links. The key must be tried before fixing the lock, in order to ensure room for the movement of the bolt. The smallest keyhole that will allow the key to pass is the best, and the hole should be so bored that when the lock is applied the key-pin is in the centre of the hole. This, however, might be said of every keyhole, and of the fixing of every lock. Perhaps it is a lesser evil slightly to shift the lock to suit a keyhole cut somewhat in error than to destroy the shape and enlarge the keyhole in the attempt to rectify the error, or leave the keyhole so that the key binds in it.

Fitting Cut Cupboard Locks.—Cut cupboard locks (Figs. 427 and 428) can be put on in a similar way to drawer locks, except that the hole for the key can, if desired, be bored from the inside, which would be difficult or impossible in a drawer. The cut cupboard lock should be let in flush whenever possible, but sometimes the peculiar fixing of the striking plate prevents this, the back-plate being let in. In fixing, first bore the keyhole, and get this and the keyhole of the lock exactly opposite, and see that the face of the lock is exactly flush with the edge of the door. Mark with a pencil round the body of the lock and the length of the face-plate, and let these in until the back-plate lies on the back of the door (but not let in); next the key can be tried in the lock, and it must enter readily before the back-plate has been finally let in; then if the key does not enter exactly, the lock can be shifted a trifle, but to do this after the lock has been let in spoils the job entirely.

Fitting Rim Locks on Doors.—Rim locks (Fig. 423) are the ordinary cheap locks fixed on bedroom doors. First let the flange (the projecting lip of the face-plate) into the edge of the door, and then, holding the lock in its position, mark through the keyhole and the spindle-hole with a scribing tool, or bradawl, on to the face of the door. Remove the lock, bore the keyhole top and bottom right through the door with a bit, so that the shoulder of the key passes comfortably through, and finish the work with a keyhole saw or small chisel. The shoulder, or stop, abuts against the lock plate, and keeps the key in its right position to enter and turn. If the keyhole is too large, it does not guide the key exactly to the hole in the lock, but allows the key to strike the lock in a very annoying fashion. Bore the hole for the

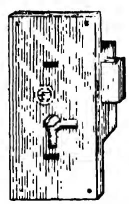


Fig. 429.—Straight Cupboard Lock.

spindle exactly square with the face of the door; if the hole is out of truth, the worker will find on attempting to screw up the knobs that they bind, and prevent the latch-bolt from springing back freely when the knobs are turned. The holes for

the spindle and the key should be bored as nearly to the proper size as the bits can be obtained, and preferably Jennings's bit should be used, care being taken not to force it to cut faster than it is made to do. A $\frac{5}{8}$-in. bit answers for an average key-

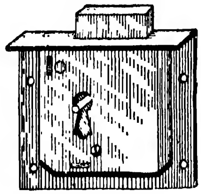


Fig. 430.—Till or Drawer Lock.

hole. It is essential to the proper entrance of the key and passage of the spindle that the holes for them be square to the surface of the door, when a square is applied with the stock horizontal as well as vertical. A serviceable guide for the boring bit is a turned piece of wood—say, 6 in. long—with a truly central hole from end to end, and a disc shouldered on. But, though such a guide is useful, this refinement of accuracy is not needed for the keyhole of a rim lock. It will be true enough if the precaution is taken to hold the head of the stock at the same height as the point of the bit, and in the other direction as square as the workman can judge. When the bit ceases working, do not force it, but remove the chips if they should be filling the grooves of the bit, and examine the other side of the door to see if the point has got through; if it has, the hole may be completed from that side. Another hole should be made for the bit of the key with a boring bit of suitable size, and the two holes cut into one by a keyhole saw. Take care not to cut away too much, which a crooked saw will be almost sure to do; but to avoid this risk cut once only in the middle of the wood between the holes, and complete the work with a thin chisel. The hole for the spindle can be bored with a $\frac{1}{2}$-in. bit, and if each hole has been made carefully, nothing remains but to screw the lock on and fix the box staple. Round-headed screws are mostly used for rim locks, and ordinary flat-headed screws for the face-plate. Put on the knobs and spindle, and the escutcheon, or keyhole plate; this plate is generally fixed with escutcheon pins. The knobs and spindle, together with the escutcheons and finger-plates, are generally termed lock furniture in the trade; when ordering, specify rim or mortice lock furniture, as the case may be, as there is a distinct difference between the two. Do not buy the old-fashioned knobs simply secured to the spindles with a screw, a most unsatisfactory arrangement, and one that is bound to give trouble at an early date. There is a great number of patent knobs in the market, and some of the best of them are the cheapest, and cost very little more than the old-fashioned sort. Cutting in the edge may be needful in the fixing of the box staple; or, on the other hand, the staple may require mounting on a piece of wood. In either case, see that the bolt and latch of the lock have just enough freedom when the door is locked—say, about the thickness of a veneer or stout card. If there is a moulding round the frame, the box staple must be let into it, fitting it very carefully.

Fitting Straight Cupboard Locks.—Straight cupboard locks (Fig. 429) do not need cutting in, but are unsightly. They have an advantage not possessed by a cut cupboard lock, of being equally available for right or left. Their fixing is very simple, as they are merely screwed flat on

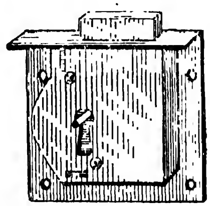


Fig. 431.

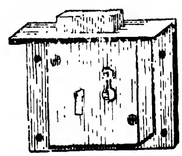


Fig. 432.

Figs. 431 and 432.—Till or Drawer Locks.

the door. The position of the keyhole is got by measurement, and as the bolt shoots out on both sides it is both right and left hand; this advantage, combined with the facility of fixing, makes its use very general.

Fitting Till or Drawer Locks.—A till or drawer lock (Figs. 430 to 432) presents some difficulty to inexperienced workers, but by taking each detail singly, and being careful to do each correctly, a neat job can be made. First ascertain the centre of the drawer front and mark it lightly with a pencil. The length of the flanges of the lock should be measured carefully, and this distance marked off on the top edge of the drawer; then the lines are squared on the edge and down the inside, as shown at A, B, C, and D (Fig. 433). Take care, of course, that the centre of the keyhole corresponds with the centre of the drawer already determined. With a marking gauge set to the breadth of the top flange, gauge the line E; set the gauge exactly to the breadth of the wide flange and make line F. Set out the socket for the body of the lock as shown by G, H, K, L, M, N, and with a fine saw cut along the lines G N and K L; of course, these cuts will terminate at the lines H and M, and will, therefore, be slanting cuts, not being the depth of the lock at the bottom, but being cut to the proper depth by a mallet and chisel. The waste between the lines may be removed by these tools, or by simply paring out with a chisel. Next carefully remove the wood for the flanges of the lock as indicated at Fig. 434. If care has been taken, the lock will then be found to fit satisfactorily. The position of the keyhole must now be set out. The pin usually projects a little beyond the body, and as the lock is pressed into position the end of the pin will make a small indentation. Place the edge of a very fine bradawl directly in the centre of this indentation of the pin, and bore squarely right through to the front of the drawer. Take a small centre-bit, or, better still, a twist-bit, place the point in the hole made by the bradawl and bore right through. To prevent the bit splintering the wood inside, a piece of waste may be held against it. With a slightly smaller bit, in a similar manner, bore through for the hole for the bottom of the keyhole. With a fine keyhole saw remove the wood between these holes, or pare it away with a small chisel. The lock should now be placed in position and the key tried in; if it is satisfactory the lock may be fixed by the insertion of two or four screws. An escutcheon may be let in flush on the outside, and it may be necessary to enlarge the keyhole somewhat to fit this in; it must be remembered that this kind of escutcheon must be pressed in sufficiently tight to hold, but at the same time not so tight as to force in the fibres of the surrounding wood. Thread escutcheons may be marked on the work by pressure or a slight tap with a hammer, which will imprint the outline of the escutcheon. To cut the bolt hole in the rail above the drawer, insert the key in the lock (when the drawer is open), turn up the bolt, and

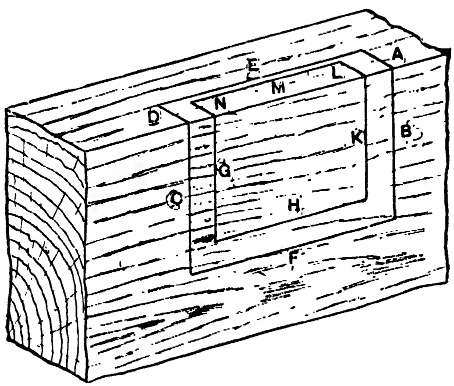


Fig 433.

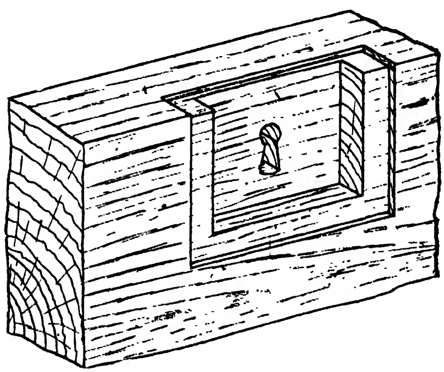


Fig. 434.

Figs. 433 and 434.—Fitting Till or Drawer Lock.

smear the end with some black material, such as lampblack mixed with a drop of glue, or use soiled oil from an oilstone; turn down the bolt, shut the drawer, and

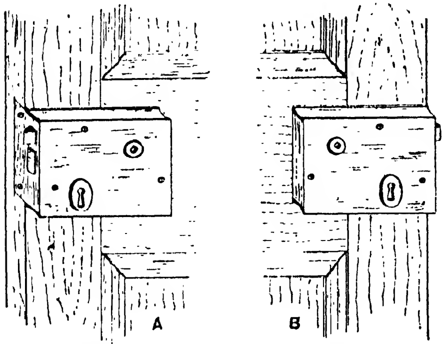


Fig. 435.—Right-hand (A) and Left-hand (B) Locks.

again turn up the bolt several times so that it strikes against the rail above. After removing the drawer, almost the exact shape of the bolt will be found marked on the rail, and the space thus marked should be chiselled out so that the bolt does not strike against its top. Another method of fitting is to find the position of the keyhole by exact measurement, and to bore the top hole at the first operation; the nipple will then fit in the hole, and the recess to be cut out and the sinking for top flange are marked round the lock. It is then impossible for the keyhole to be wrong.

" Handing " of Locks and other Fittings.—The handing of locks and other ironmongery is apt to be somewhat puzzling. When a joiner is fixing a right-hand rim lock, he fixes it on the left-hand side of the door, and vice versâ (*see* Fig. 435, in which A indicates a right-hand lock on the left-hand side of the door, and B a left-hand lock on the right-hand side of the door). Similarly with casement fasteners, as shown in Fig. 436, where C is right-hand on the left-hand side of the casement, and D left-hand on the right-hand side of the casement. Much has been done by manufacturers to avoid the question of handing. Reversible latch bolts are fitted to locks, and casement fasteners are often made symmetrical and therefore reversible. Some casement fasteners are fitted with a screw which allows the cockspur itself to be taken off and turned round; but this is not always satisfactory, because in use the screw is continually either binding or becoming loose. The fixing of a right-hand article to the left side of an opening, or vice versâ, as noticed above, is not quite so paradoxical as at first appears; for in each instance there are some words which are understood as emphasised below, which have gradually been omitted in the usage of the ironmongery trade. Locks, rim, WHEN FIXING, LATCH KNOB ON THE right hand. Locks, mortice, and shop locks with cranked handles, in agreement with the last. Handles: BENT TO THE right hand (*see* Fig. 437). Lock plates: PROJECTION TO THE right hand (*see* Fig. 438). Casement fasteners: HANDLES TO THE right hand (*see* Fig. 439). Espagnolette bolts: in agreement with last. Hinges: WHEN OPENING THE DOOR FROM YOU, ARE ON THE right hand (required for rising and lift-off butts, etc.). Portière rods (where any of the fittings are handed) should be, when looking at the rod as fixed, HINGED ON THE right hand (*see* Figs. 440 to 444).

Lock Repairing and Key Fitting

Appliances and Tools.—The tools required are not many: a 2-in. parallel vice, hammer, screwdriver, four files—one 8-in. half-round

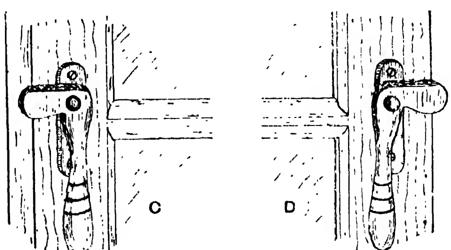


Fig. 436.—Right-hand (C) and Left-hand (D) Casement Fasteners.

medium file, one 6-in. and one 3-in. ward file, and one $\frac{3}{16}$-in. square file; a few small cross-cut chisels; a centre-punch; a few flat punches; and a hack-saw. Soldering

materials will also be needed, and emery cloth for polishing keys and lock fittings. Two specially useful tools can be made out of two pieces of $\frac{3}{8}$-in. by $\frac{1}{4}$-in. iron.

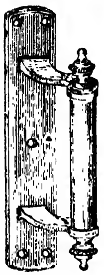


Fig. 437.

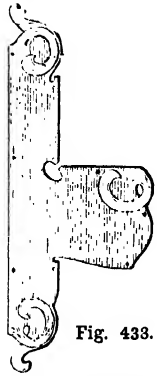


Fig. 438.

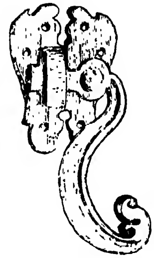


Fig. 439.

Fig. 437.—Right-hand Handle.
Fig. 438.—Right-hand Lock Plate.
Fig. 439.—Right-hand Casement Fastener.

Cut one piece $7\frac{1}{2}$ in. long, and round taper it, $1\frac{1}{2}$ in. from the end, to $\frac{1}{16}$ in.; in the other end cut a **V**-groove. Bend over the **V** end 2 in., then make two more bends, 2 in. each, to form a square, leaving the $1\frac{1}{2}$-in. tapered end parallel with the bottom, with $\frac{1}{2}$-in. space from the **V** end to the $\frac{1}{16}$-in. end. Cut the second piece 6 in. long; swell out one end, and bore in it a $\frac{1}{16}$-in. hole; **V**-groove the other end and then bend on the 2-in. and 4-in. marks, bringing the **V**-groove end opposite the swelled end. With these tools and a pair of callipers it is possible to do first-class work. The box which covers the screw of the vice makes a good hammering block for drawing key webs, and forms a rest for the web in cutting large wards in plate lock keys. The files are used for cutting keys and general lock repairs; the callipers for gauging keys to pattern; the centre-punch and flat punches for punching pins, broken spring ends, and lever spring ends, also for punching holes in standards, etc., of locks. The hacksaw is required for small wards and general work, and the solde ing-bit, etc., for broken parts and pins. The two special tools described are useful in cutting lever keys, one for pinned and the other for pipped keys, and also in polishing; they are fastened in the vice parallel with the tapered part, or **V** and swelled end, allowing clearance for the working of the webs of the keys. This saves time in fitting and gauging, and the tool does not mark the keys as the vice would. The key is held in one hand, and the cutting is done with the other. Cut every ward space or lever space as square as possible.

Bow, New, on Old Key.—Sometimes a new bow will be required on an old key, or a key has to be lengthened. Prepare the two parts, allowing $\frac{1}{4}$ in. over the required length, and cut a slot in one piece, fitting the other piece tight into it. Then braze the joint with spelter or powdered borax and brazing wire wrapped round the joint of the keys. When brazed, it is finished off with the file, and the key polished up. Hard soldering will answer if brazing cannot be accomplished.

Key Fitting.—In cutting pattern keys, measure up the parts of the key with the

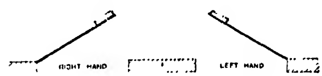


Fig. 440.—"Handing" of Locks and Latches.

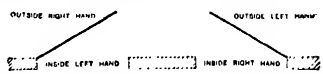


Fig. 441.—"Handing" of Casement Fasteners and Bolts.

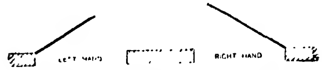


Fig. 442.—"Handing" of Hinges.

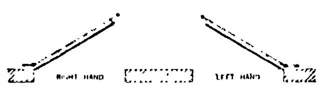


Fig. 443.—"Handing" of Portière Rods.

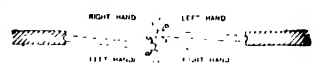


Fig. 444.—"Handing" of Handles and Lock Plates.

callipers, and fit accordingly. When taking a lever lock apart, note the position of each part, and mark every lever as taken out, if not already marked. Fit the key to the

open bolt first, and then fit to every lever as put back till all is complete. With ordinary cabinet, box, and drawer locks, and with padlocks, the keys can be fitted without taking the lock to pieces. First get the web of the key bright, and then blacken it with the smoke of a lighted match. Insert the key in the lock, and work about with it; when taken out it will indicate the wards that want cutting, and the length required for the shooting bolt. If a plate lock key is of a difficult pattern, and one web is broken off, draw a piece of iron down to the size of the opposite web; then bore a small hole in the pin of the key, file the iron end to fit the hole, and cut the wards opposite. Cut to length, and then braze the end in the hole. This method, however, applies to repairing large keys only, where a new blank cannot be obtained.

Lock Repairing.—Locks are rather tedious to repair at times. Plate lock springs can be

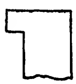


Fig. 445.

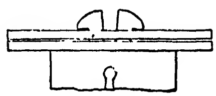


Fig. 446.

Fig. 445.—Bolt of Piano Lock.
Fig. 446. Bolt of Roll-top Desk Lock.

made out of suitable spring steel, cut and filed to shape and tempered, but the end to be riveted should be softened. If, after the broken end has been punched out, a key is not long enough to shoot the bolt beyond the catch lever, the web of the key can be drawn, or the catch lever drawn, by hammering from the centre of the lever towards the catch, till the required length is attained. The standards which support the ward guides, if broken, can be cut out of sheet iron, fitted and riveted, and the centre guide-plate, with inside collar and ward pins, cut the same way, with collar and wards brazed in. If the key has plenty of play, and the lock-plates are worn, get two washers and cut away to fit the key-pin and web; file bright one side and the edges, and the corresponding part of the lock-plate, and solder one on each outer side of the lock-plates. The shoulder of the key may want cutting farther back if the washers are thick. Assorted springs and blank keys can be obtained at any ironmonger's for a few pence. Some rim lock springs are fitted as plate lock springs, and some are slotted into a catch lever. New parts can be made similar to plate locks. The latch lock springs are easily done, as they are bought practically fitted; but they may require cutting and bending if too long. If one spring is not strong enough, place one spring inside another, to obtain the required strength. If the bolt of the latch lock is broken by the forcing of the door, a plate riveted and soldered on will make it strong enough, if one cannot be cast. New pins for locks can be made out of rod iron fitted and riveted. Pins for cabinet and box locks and padlocks can be made out of nails, the head being hammered to the size of the hole and fitted and riveted. If the pins in the lock are loose, they can be riveted or soldered, and the outside of the lock finished level. New springs to common cabinet and box locks and padlocks may be fitted as above, but if anything else is required a new lock will be cheaper. Springs for lever locks are best made of piano wire. Flatten all the length wanted, drive the spring tight into the slot of the lever, and cut to length. When keys are lost, extra wards can be inserted in the lock, to prevent the lost keys being used if found by strangers, by drilling a hole in the lock-plate and fixing the ward pin, then cutting the keys to correspond with it. The same can be done with the lever lock, making it a ward as well as a lever lock; but the quickest way is to change the position of the levers, and fit the key accordingly. Spiral springs can be made of fine gauge wire, wound round a nail or piece of thick wire.

Picking Locks.—Lock troubles are very frequent, and the repairer is often called upon to open a locked drawer or door of which the key has been lost. It is advisable to keep a bundle of old keys for this purpose, and some lock picks; but these are not always necessary, for in many cases simpler and quicker methods can be employed. For instance, in the case of a drawer, if the top side of the rail into which it locks can be got at, a sprig-bit may be used to pierce the wood till it touches the

bolt of the lock, and a smart tap with the hammer will send it in. If this is impracticable, the rail can be prised up to get as much space as possible between it and the drawer, by inserting a wedging tool; then an impression can be made with a fine drill on the bolt to take the point of a sprig-bit, for the purpose of levering it back. It sometimes happens that a drawer or door cannot be unlocked even with the correct key, and the barrel does not require picking. This trouble may be caused by the slot into which the bolt shoots not being deep enough, the pressure holding it in such a position that the key cannot move it either way. By prising it as just described, the key can first be turned to send the bolt to its full extent; it will then unlock easily. The slot should afterwards be deepened to prevent recurrence of the trouble. Damp weather often expands a drawer front $\frac{1}{8}$ in. in the width, so sending the lock forward. The bolt of a piano lock is of the shape shown by Fig. 445, and shoots into the slot, then to the left to hook behind the brass slot-plate; the same principle is used in desk and chest locks. In this case they can be opened without a key by inserting a thin, square-pointed blade and forcing to the right, at the same time lifting the fall or lid. Roll-top desks are fitted on a similar principle, but the bolt springs apart and shoots to both right and left (*see* Fig. 446), in which case, of course, two blades will be required to force them together. There are times, however, when a lock gets dislocated, or a bit of broken key gets stuck in, and defies all attempts to pick. As a last resource, put a punch in the keyhole, and drive it off inside. A box of assorted springs and one of small set-screws should be kept for general repairing.

Improving Common Lock.—It often happens that a small common box or padlock is not quite secure; the cheap locks being made in large numbers, the keys are largely interchangeable. Fig. 447 gives an interior view of a common form of lock and key, and Fig. 448 shows a modification of the same, which will often save the expense of fitting a new lock. Remove the lock, and take off the front plate. Saw a short piece off the barrel of the key, file the piece to a neat edge, and solder it to the pin of the lock. Then put the lock together, clean up the key, and replace. The short piece will now prevent other keys from entering the lock.

Locomotive Brasswork

The usual method of cleaning the large brass domes, and other brasswork, on Great Western engines, as practised by the cleaners, is as follows:—A piece of old canvas sacking is steeped in rape or any other vegetable oil, and the hot brass wiped with it. Some finely ground Bath brick is now taken up on the oily sacking, which is called a "scourer," and the brass is well scoured. Some brasses are easier to scour with an up-and-down

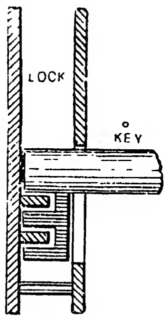


Fig. 447.

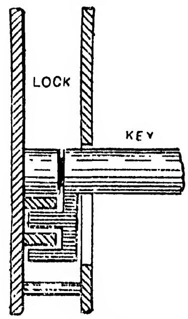


Fig. 448.

Fig. 447.—Interior View of Common Lock. Fig. 448.—Interior View of Common Lock, Modified.

motion, while others are more readily scoured crosswise. After wiping off, well polish till all grease is cleared from the brass, and then soot well. The soot patch is made by rubbing a patch of waste up the fronts of tubes or blast pipe in the smoke box. Except in dirty weather, the brasses retain their brightness all day. Ordinary Bath brick ground up and mixed with engine-oil makes a good polishing paste for hot brass. Scouring the brass well with this, and then polishing with a hot rag, produces a polish like silver. The principal thing is to polish well after scouring with a well-dried cloth.

Logwood

A closed pan provided with a safety valve and heated by steam from a boiler is

used for preparing logwood extract; but on a small scale a boiler heated by fire could be employed, the safety valve being set to blow off at 5 lb. or 10 lb. pressure. Logwood chips and water are placed together in the boiler, and heated under pressure for several hours. The liquid is then strained through a cloth, and evaporated in a shallow pan at a gentle heat until it is of a syrupy consistency. An extract can also be made by using alcohol or methylated spirit as the solvent, but there is no advantage in this, the solvent being expensive, and it requires to be distilled off in a still, otherwise it is wasted.

Lubricants

Cycle Lubricants (*see* Cycle).

Graphite.—Information on the use of graphite as a lubricant is given under the main heading "Graphite." Satisfactory lubrication in an engine depends as much upon the condition of the surfaces as upon the quality of the lubricant itself, and the smoother the bearing surface can be made, the easier it is to lubricate. When graphite is introduced between friction surfaces it soon rubs into the metal, filling every pore, crack and irregularity in the surfaces, and coating them with a firm, durable, and exceedingly smooth veneer. Cylinders in which graphite has been used take on a wonderful, mirror-like polish, and valves work quietly and without straining or cutting. Bearings on which graphite is used are not so liable to overheat, and overheated bearings are rapidly cooled; also it is a fact proved beyond any question, that "seizing" and cutting of friction surfaces cannot take place in the presence of graphite. Impure graphite is useless as a lubricant.

Grease for Lubricating Purposes.—A white grease can be prepared by heating 100 parts of the mixed oil and tallow with 15 parts of soda crystals (washing soda) and 180 parts of water. Soft soap is one of the best materials for emulsifying oils and fats; for 100 parts of oil and fat add 2 parts of soft soap dissolved in a little hot water. To stiffen and cheapen the grease, French chalk may be added; this is a valuable addition to greases for heavy machinery.

Lubricant for Oilstone (*see* Oilstone).

Lubricant for Ropes.—Oil should not be employed. The "American Machinist" says that for manilla ropes, flake graphite should prove satisfactory, but it ought to be applied in the spinning process. Cotton ropes ought to be very sparingly dressed with some composition, just sufficient being used to prevent fluffing. A much used mixture is graphite and molasses or treacle, very little being applied at any one time. An oiled rope becomes sodden and soppy, and may be remedied by repeated application of powdered chalk to absorb the oil.

Lubricant for Reamers.—A lubricant recommended for reamers by an American mechanic is a mixture of tallow and flake graphite. With this lubricant, he says, any old, out of round, hand-ground reamer works smoothly.

Lubricant for Sewing Machine.—Sewing machine lubricating oils are many in number. The four following have been recommended: (1) Sperm oil to which a little paraffin oil has been added. (2) 1 part of melted paraffin wax mixed with 7 parts of paraffin oil; this should stand for some hours, and then be decanted. (3) Mix and filter 9 oz. of pale oil of almonds, 3 oz. of rectified benzoline, and 1 oz. of oil of lavender. (4) Mix and filter 3 oz. of petroleum, ½ dr. of essential oil of almonds, and 9 oz. of pale nut oil.

Lubricant for Wood Gearing.—For lubricating wood gearing, the following compound is recommended:—Melt together at a moderate heat 30 parts (by weight) of tallow, 20 parts of palm oil, 10 parts of fish oil, and introduce while stirring, so as to obtain a perfectly homogeneous mixture, 20 parts of graphite carefully washed and pulverised.

Lubricating Oil, Clarifying.—To clarify watch lubricating oil, place clean lead in it, bottle, and expose to sunlight.

Lubricating Oil, Testing.—To test lubricating oil, elaborate apparatus is not necessary. Its gumming tendency can be judged by spreading a very thin layer on a sheet of glass, covering this to protect it from dust, and then exposing it to sunlight, or to slow, dry heat. Viscosities can be compared by allowing drops to fall from a funnel, terminating in a pin-hole orifice,

and counting the number that fall per minute. When a drop of oil is let fall on a piece of clean blotting-paper, the time taken by the mark to spread and to disappear, under the inducement of heat radiated from a hot plate below, on which the paper is laid, also furnishes a criterion of the quality of the oil; mineral oil spreads and disappears quickest. In making practical tests it is necessary to see that the bearings are quite clean at the start, or the virtues or defects of a former lubricant may be laid to the account of the oil under trial. A comparative test for lubricating oil is to place a drop of each of the oils to be tested in line upon an inclined glass plate, about 8 in. wide and from 24 in. to 30 in. long; the inclination should be about 6 in. The drops of oil start on a race with each other, and the one that goes the farthest may be considered the best for lubricating. Sperm oil will be in the rear for the first day, but then will overtake the others, and probably be found in motion when all the others have dried up; oils having a light body run quickly, but dry quickly also, whereas an oil with both body and a free flow will run well, but not be dried up so soon. Any tendency to "gum" will be detected easily by this test, which must be conducted away from all dust. A good plan is to cover the glass with a transparent shade.

Lubricating Oil: Detecting Acid.—Acid in lubricating oil may be detected by putting a little of the oil in shallow copper dishes, which can be made easily by depressing pieces of copper sheet with a heavy round-faced hammer. Any acid present will attack the copper and produce verdigris.

Lubrication.—To illustrate the principle of lubrication there is an experiment which anyone can try. A surface which is perfectly smooth to the eye is the best that can be made, but under the microscope it shows multitudes of little abrasive points. Take a smooth file, and press it ever so gently over a hard metal surface; it will do its work perfectly, tearing off little particles of the metal, but still leaving the surface smooth. Now rub the hand over the metal and the greasiness of the skin will so change its condition that the file will no longer bite, but will push over it, even with added pressure, without abrading it. This illustration carries with it every principle of friction and lubrication. The tiniest wearing surface of a watch pivot polished and finished to the highest degree, and revolving in its jewel, has on its surface as perfectly developed abrasive points as the file.

Luminous Bottle

A non-drying oil, like olive oil, is best for a luminous bottle. Dry the phosphorus by carefully pressing it, without rubbing, between blotting-paper; then place it in a dry bottle, which should be about half filled with oil, cork the bottle, warm it gently, and shake it vigorously from time to time so as to get as much of the phosphorus dissolved as possible. When opening the bottle, blow into it to displace its contents by fresh air. As is well known, the luminosity is due to the slow combustion of the phosphorus dissolved in the oil.

Luminous Paint

This may be made as follows:—(1) Mix finely powdered calcium sulphide in any colourless varnish, or in equal parts of boiled linseed oil and turpentine, to the required consistency. The sulphides of barium or strontium may also be used. (2) Heat together, in a crucible, plaster-of-Paris and charcoal. The resulting substance—calcium sulphide—is mixed with a vehicle as before. (3) Heat lime and sulphur together in a crucible, and well powder the residue. In each case, exposure to daylight is necessary to produce luminosity.

M

Machine Belts (*see* Belts)

Mackintosh

Cleaning Mackintosh.—(1) Take 4 oz. of white Castile soap, cut it into thin shavings, and boil in 4 oz. of water till dissolved, then stir in 1 oz. of light magnesia; pour the whole on to a cold plate, and roll it into a ball. Now with a nail-brush, water, and the soap go gently over the mackintosh; clean off the dirty soap and water with clean wet cloths after each portion is done, and finish by washing with clean water. Finally spread the mackintosh out on a clothes-line and allow to dry. (2) Sponge the cloth with benzoline to which has been added a little finely powdered chalk or fuller's-earth; allow to dry in the open air, and then brush out the dry powder. The operation should be performed away from any flame.

Mackintosh becoming Hard.—There is no remedy for a mackintosh that has become hard, as the rubber is perished. It can be opened out and made wearable for a time by soaking it in hot water till pliable, but it will not remain soft or resist any heavy rain.

Patching Mackintosh.—The patches should be cut from similar material to that of which the mackintosh is made, and they should be cemented on with rubber solution. First the patch and the part it is to cover should each receive a coat of the rubber solution, which should be allowed to dry on; then another coat of solution is applied, the patch is placed in position, and a weight kept upon it till next day. Seams may be mended by opening them out and applying a coat of rubber solution to each side; then press them together, and iron with a warm iron.

Magnetising

The quickest and best method of magnetising steel bars is to wind round them several turns of a length of copper wire. This wire must be properly insulated, and should be connected by suitable means to a battery, accumulator, or dynamo. The current thus obtained will magnetise the steel. The degree of the magnetisation will depend entirely on the properties of the particular brand of steel being dealt with; but in any kind of steel the magnetism will vary with the "ampère-turns"—that is, with the current in ampères multiplied by the number of turns taken by the wire round the steel core. On withdrawing the coil, or cutting off the current, the magnetism will be reduced, but not to zero, the amount retained depending, again, entirely on the material.

Making Permanent Magnets.—For this purpose hardened steel should be used, and it is said that tool steel answers well if hardened and drawn to a straw colour. A coil of copper wire should be placed over the steel rod, and an electric current passed through the coil, care being taken therefore to insulate each turn of wire from its neighbour. The time required magnetically to saturate the steel, and also how far the effects will be permanent, depend on the hardness of the steel. In magnetising, the electro-motive force of the current does not matter, the number of turns taken by the insulated copper wire round the steel core and the strength of current in ampères, together with the permeability of the core.

determining the strength of magnetic field set up. The permeability depends on the material employed and the degree to which the material is magnetised; but the ampère turns, as explained above, are, of course, under the control of the worker. To sum up, for great magnetic strength use many coils or turns, and as high a current as can be obtained. The magnetising effects depend on the product of these two factors.

Mailcart, Perambulator, etc.

Fixing Tyres on Mailcart.—Clean out the rim and under side of the tyre with a paraffin rag. Melt up some good tyre cement (obtainable at any cycle depôt) in an old iron saucepan or ladle, pour it evenly round the rim (about a third full), let it set, then place the tyre in position and heat up the under part of the rim till the cement commences to boil out. The rim should be heated by a gas blowpipe, a blow-lamp, or over an ordinary Bunsen burner or a plain gas-jet. Keep the wheel moving, or the tyre will burn.

Re-covering Hoods.—Perambulator and mailcart hoods are covered in all kinds of materials. American covered leather is mostly used; it is now manufactured in many colour shades, is waterproof, and can be bought up to 2 yds. wide. Its chief defect is that the enamel surface is susceptible to scratches and cracks, which cannot possibly be removed. A stout variety, specially suitable for hoods, is known as "American duck." Common roan skins are used in better-class perambulators, and wear well, being supple, and keeping a good appearance. Coloured satins, sateens, and even silks are employed on some of the lighter class mailcarts, but are not suitable for damp or wet weather. A hood cover generally consists of four separate pieces, namely, back, two sides, and top, which are joined together with welted seams; these pieces are cut from carefully measured templates. In the actual process of re-covering a mailcart hood, first strip off the old cover, rip the seams, and use the pieces as patterns to cut the new one from, allowing for seams and turnings. Then strip off the gimping from the body edge and front hoop-sticks, and prise out the tacks which hold the cover with a small screwdriver. Get the old cover off intact if possible, then rip the seams, and the cover will be found to be made up of four separate pieces—two sides, top piece, and back. Choose a fair quality of leather cloth, fairly flexible, with a backing of medium texture. Lay the pattern on this, and cut out. The pieces must be seamed together and overseamed to the same shape as the old hood. When ready, place in position, getting the cover straight and free from wrinkles; then put one tack in the centre of the back piece, and one in the middle of the front hoop-stick. Tie the hoop-stick to the shafts with a piece of string, in a position just short of full stretch; then strain and tack off alternately at each side until all is made fast. Put the rule joint in position, and if the cover is not sufficiently tight when the joint locks, alter its position to a little nearer the front, until all is taut and straight when locked up. The border may be covered with new gimp or banding, and the hood relined, if necessary, after the outer cover is put on. The lining is tacked to the back hoop-stick, inside, if this is of wood; if of iron, the lining will require basting on.

Renovating Bassinette.—Strip off the leather banding round the hood (assumed to be brown American cloth) and edges, and wash the leather with a sponge and warm water in which a piece of washing soda has been dissolved; then make a solution of 1 oz. of bleached shellac to ½ pt. of spirit. Now get a pennyworth of brown aniline spirit dye and a small brush; dip the brush into the polish, then take up a small quantity of the dye and touch up the faded parts. Put the remainder of the dye into the polish, allow it to dissolve, and give the whole of the leather two thin even coats, laid on with a sponge or broad camel-hair brush.

Maize Starch (*see* Starch)

Mandoline

Renovating Mandoline.—If properly repaired, an old mandoline may be better than a cheap new one. Glue joints that have given way must be made sound; simply working in glue does not suffice. The joints must be brought close together,

as the shape of the instrument does not allow cramps to be used. The joints are generally tied round with tape, wood wedges being pressed under where required. The pin holes can be filled up with cabinet-makers' hard stopping or coloured wax, and the face also cleaned up with a steel scraper and glasspaper. Repairing generally brings about the necessity of french polishing, as the instrument cannot be satisfactorily varnished.

Cleaning Mandoline. — Mandolines are usually cleaned by means of a steel scraper and glasspaper. The next best plan is to use a dilute solution of oxalic acid—½ oz. to 1 pt. of water—and fine pumice powder. Dip a piece of clean rag in the solution; take up a quantity of pumice on this, and rub till the dirt is removed; the stains will bleach out. Wipe off surplus wet, using another piece of clean rag; a trace of whiting sprinkled at this stage is an improvement, if it is well rubbed in.

Mangling and Wringing Machines

Cleaning and Repairing Machines.—It is not proposed to deal in this article with what is known as the box mangle, which is principally composed of joinery work, or with wringers in which indiarubber rollers are used, but with that type of machine now so largely employed in which the pressure is obtained not by weight, as in the box mangle, but by an elastic steel spring bearing upon two wooden rollers, the framework of the machine being composed of cast iron. This class of machine is made in a great many different patterns by different makers, but the principal and working parts are, as a rule, very similar in all. The machine is shown complete at Fig. 449. The upright sides each consist of one casting, and are identical except for the stud or small spindle, which in the machine here described is cast in one of the sides to carry the stud-wheel, to be presently described. In some cases the stud is movable, and fastened by a nut, each of the sides having a hole for the stud, which, as will be seen later on, is an advantage. Each side has two small iron roller-wheels at the base on which the machine rests, and these are fastened by movable bolts. Sometimes the spindles passing through these wheels form part of the casting of the side. When this is the case, one of these wheels, when broken, can only be replaced by putting in a new side or drilling holes for a bolt. The bow spring is well secured to the sides by four small bolts, as shown in Fig. 449. The pressure screw—a strong, square-threaded screw—passes through the bow spring, and when screwed down on to the elliptic steel spring, produces the necessary pressure between the rollers. E is the spring bar for equalising the pressure; the bottom rail for holding the sides together at the base is fastened by four small bolts to the sides. The guard, a single casting, covers the star-wheels and prevents anything coming between the cogs; it is bolted to the side by a single bolt at its lower extremity. The fly-wheel has a handle and a set of nine teeth or cogs, as they are generally called, by which the motion is communicated to the machine. It is held in position on the spindle by a collar or cast-iron hoop and set-screw A. J is the plate-wheel, with twenty-nine cogs, keyed on to the roller spindle; this is shown separately in Fig. 450. K is the stud-wheel, with a double set of twenty-nine and nine cogs to correspond with the plate and fly-wheel (*see also* Fig. 451). At the other side are two star-wheels under the guard, with eleven cogs each, and keyed on to the ends of the roller spindles. One of the star-wheels is shown separately in Fig. 452. They serve to communicate the motion from the lower to the upper roller. The two wooden rollers are 24 in. long and 5⅞ in. diameter, turned out of sycamore. Two iron spindles pass through the rollers, the lower one projecting 8½ in., to carry the plate-wheel and fly-wheel, and both projecting 4 in. at the star-wheel side. The part of the spindles passing through the rollers is a square of 1 in., the projecting ends being circular to receive the wheels and $\frac{31}{32}$ in. in diameter. The drip-board, for the purpose of carrying the water into the tub in wringing, is seen under the rollers. A stay-bar, fastened with a nut to each side, passes under the drip-board. When this stay-bar is tightened, it draws the

sides together and holds the drip-board in position. A mangle-board or table (not shown in the figure), $25\frac{1}{2}$ in. long by 9 in. wide, fits in slots in the casting both at the back and front of the mangle. The bearings for the spindle of the bottom roller form part of the sides of the machine ; pair of callipers ; a few iron washers large enough to fit on the spindles of the-rollers, and some keys for the wheels should also be procured. The keys are pieces of malleable iron about $1\frac{1}{2}$ in. long by $\frac{3}{8}$ in. by $\frac{3}{16}$ in. It will be assumed that it-is required to clean and paint the machine thoroughly, and

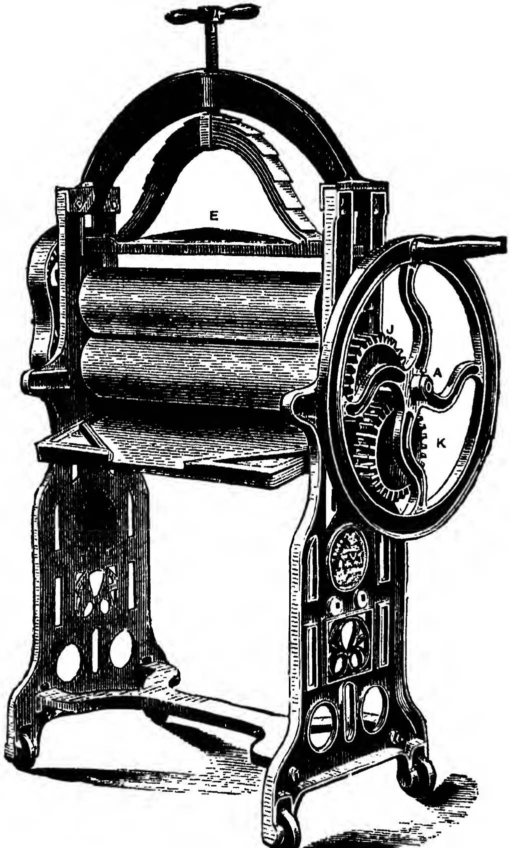


Fig. 449.—Mangling and Wringing Machine.

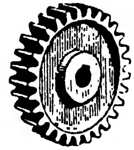


Fig. 450.—Plate-wheel.

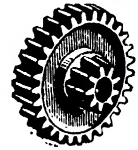


Fig. 451.—Stud-wheel.

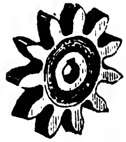


Fig. 452.—Star-wheel.

Fig. 453.—Bearing on Spindle of Top Roller.

Fig. 454.—Collar with Set-screw.

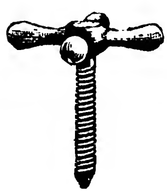


Fig. 455.—Pressure Screw.

Fig. 456.—Spanner.

a cast-iron bearing (shown also in Fig. 453), 4 in. high, rests on the spindle of the top roller at each side, the spring bar resting on the bearings. The principal tools required in repairing a mangle are a spanner, such as shown at Fig. 456, or an adjustable wrench to fit the nuts, an engineering fitter's hammer and chisel, a flat, cross-cut file, say 12 in. long, with a safe-edge at one side, a vice, a pair of pincers, a rule, and to replace some broken wheels or fit new rollers. The collar A (shown also in Fig. 454) should be first removed by loosening the set-screw ; the fly-wheel can then be taken off. This set-screw should never be tightened more than is just sufficient to set the collar on the spindle, otherwise the collar is sure to split. The guard should next be removed by loosening the nut that holds it at the bottom. The four bolts that hold

the bow should then be removed, the bow lifted off, and the spring and spring bar taken out. The bearings and rollers, with their wheels attached, can then be removed from the frame, the split pin in front of the stud-wheel taken out, and the wheel removed. It will generally be found that the wheels are covered with oil, etc., used to lubricate the machine. To clean them, it will be necessary to remove the two star-wheels and plate-wheel from the spindles. To do this, the end of the spindle should be placed on a firm support, with the wheel to be detached uppermost, and a few sharp blows struck with the hammer on the hub or part of the wheel nearest the spindle, so as to drive the wheel towards the roller. When it has been moved about an inch, the key which fastens it on the spindle can be removed and the wheel taken off. In cleaning mangles, the most effectual way to remove the oil and grease from the two star-wheels, stud-, plate-, and fly-wheel, and two bearings, is to burn it off. If a fire of wood can be lit in a yard or garden, and the wheels placed in it a couple at a time, it is about the most convenient method; or they can be heated in an ordinary open grate if large enough. In any case, a wood fire is best. With regard to the fly-wheel, only the part bearing the cogs will require to be heated, avoiding the wooden handle. When the grease has all been burned off, the wheels should be allowed to cool gradually, not dipped in water. They can then be brushed to remove the dust, etc., and given a thin coat of Brunswick black. The spring, spring bar, and top of pressure screw (which do not generally require firing) should also receive a coat of Brunswick black. All dust and grease should then be removed from the framework and bow by scrubbing with a brush, and, if necessary, scrubbing with a pail of hot water in which a handful of soda has been dissolved. When dry, the framework and bow can be painted. The colours most in vogue with mangle makers are red and green. Whatever colour is used, some finer's varnish should be mixed with the paint, as it gives the work a brighter appearance. It is very usual to paint the edges of the flanges of castings a different colour from the rest of the work—say, the body of the castings green, and edges of flanges lined with red. The rollers of a mangle are the parts that receive the greatest amount of wear, and generally require to be renewed first, especially the bottom roller. If the rollers have been a pair of $5\frac{7}{8}$ in., and when measured with the callipers in the middle measure $5\frac{1}{4}$ in. or upwards, they will bear turning down in the lathe; or the top roller may be turned if a new bottom roller is fitted. It will generally be found that if rollers are reduced much in diameter from their original size, the star-wheels will not work properly. This is caused by the cogs fitting too closely together. The only remedy is to get a pair of star-wheels of smaller diameter. If the repairer has a lathe large enough, he will probably wish to turn his own rollers. The best way to do this is to buy the blocks in the rough, with the holes bored for the spindles. The square on the spindles in the machine described, as before stated, is 1 in. For this size a circular hole in the block $1\frac{1}{4}$ in. diameter would be suitable. The wood generally used is sycamore or beech, sometimes lignum-vitæ for the bottom roller. Whatever wood is used, it should be thoroughly well seasoned, as there is always considerable liability to crack, owing to the spindle being forcibly driven through the block and the rollers being afterwards necessarily subject to considerable variations of temperature. Care should be taken that the hole in the block is the right size for the spindle, for if too large the roller will work loose on the spindle, and if too small the block will be split in driving the spindle through. A convenient method of driving the spindle through the block is to place a large piece of flat iron or the like on, say, a basement floor, put one end of the spindle into the hole in the roller block, lift the block with the two hands, and bring the projecting end of the spindle smartly down on the piece of iron. By repeating this a number of times, the spindle can be gradually driven through the block, leaving the ends projecting the required distance at each side. The block can then be turned up true on the spindle in the lathe. The rollers should be

urned very slightly larger in diameter t the middle and taper towards the ends, ut only to such an extent that a thick piece of brown paper could be slipped between them at the ends when in position n the machine. This will correct to a great extent the tendency of the rollers to become hollow in the centre. Thin brass aps are frequently fitted on the ends of he rollers; these may be said to be more ornamental than useful. A much better plan is to have iron rings $3\frac{1}{2}$ in. diameter, in. thick, and $\frac{5}{8}$ in. wide, let into grooves n the ends of the rollers, which effectually prevent splitting. The wheels are all of ast iron, and should any of the cogs be broken, it is generally better to get a new wheel, although a substitute for broken cogs an be made by drilling a hole $\frac{3}{8}$ in. deep ind, say, $\frac{5}{16}$ in. diameter where the cog has been broken, tapping this with a screw hread, and screwing in a piece of iron ong enough to represent a cog. If it is equired to order any new wheels from the nanufacturer, it will not be necessary to send the old wheels for pattern if a rubbing s taken. This is done by giving the flat ace of the wheel a coat of lampblack or blacking, and placing it on a piece of brown paper so as to receive the impression of the cogs, or by putting a piece of paper over the old cog and then rubbing with blacklead or heelball. In the case of a stud-wheel both sets of cogs must be shown. The exact bore and diameter of the wheel should be marked on the paper. The plate-wheel and stud-wheel must always be of the same diameter and number of cogs, while the fly-wheel must correspond with the smaller set of cogs on the stud-wheel. Therefore, if one wheel is not forthcoming, a pattern can be taken from the other; but it is to be remarked that the bore of the stud-wheel is not generally the same as that of the other wheels. It will sometimes be found, on examination, that the part of the side under the stud-wheel has become cracked, owing to the strain of the stud. If this is so, the stud, if movable, should be put in the other side of the machine. The stud-wheel should next be placed on the stud; it is generally held in position by a split pin passing through a hole in the stud. Should it have any lateral movement, the pin should be taken out, and one or two washers put between the wheel and split pin; otherwise the wheel will shift outwards when the machine is at work, and only half of the plate-wheel cogs working on the stud-wheel, causing unequal strain and breakage. The same remark applies to the fly-wheel and stud-wheel. The two star-wheels and plate-wheel should next be keyed on, but a washer should be first slipped on the end of each spindle. These washers are to come between the wood of the roller and the bearing. To key on the wheels, they should be slipped on the spindles and the rollers placed in the machine; the proper position for the wheels can then be found, and the keyway on the wheel and spindle brought opposite each other. The keys should be filed down to the right size to fit each wheel, and should be quite flat, or nearly so; if wedge shape, they will split the wheels. They can then be driven home with the chisel and hammer. The machine can now be put together in the reverse order to that in which it was taken asunder. It often happens that, when in use for some time, the spring comes down too low to get sufficient pressure; this can often be remedied by fitting a pair of higher bearings, but they must, of course, fit the sides of the machine. On the other hand, it is sometimes found that there is a difficulty in getting the bow on over the spring. The best way to do this is to fasten the bow with the bolts at one side; get a stout piece of wood, say, 6 ft. long, and catch one end of it under the part of the bow that has been bolted down, the wood passing over the shoulder of the bow at the other side. By bearing on the free end of the wood, it can be used as a lever to bring the bow into its proper position, while an assistant can readily slip the bolts in their places.

Fastening Rubbers to Wringer Spindles.—Over a gentle heat melt slowly, in a metal can, a cake or two of the best tyre cement, being careful that it does not take fire. Whilst it is melting, warm the spindles—which must be removed from their mountings—till they are so hot that the hand can only just bear to touch them. Scrape off

any old cement that may be left on the rubber. With a piece of flat stick coat the metal spindle all over with the melted cement, and keep it hot by holding and turning it round in front of a clear fire or over a Bunsen gas flame. Warm the rubber in a hot oven. When very hot, hold one end of the spindle in a vice or bench hole, with the rest vertical, and draw the rubber tube over it slowly and steadily with both hands. The secret is to keep the cement melted till the rubber is in its final position.

Filling Up Cracks in Mangle Rollers.—Generally speaking, there is no satisfactory way of filling cracks in the rollers of mangles If the cracks are small on the surface of the roller, they will not interfere with the use of the mangle; but if the wood is peeling off in places, or the rollers are worn hollow in the centre, there is no remedy but to have them re-turned or a new pair fitted. A local wood-turner would probably re-turn them (if they are large enough in diameter to admit of this) for a few shillings. A pair of smaller star-wheels would then most likely be required. An actual experience may, however, be related. A mangle roller contained a shake (crack) which gradually opened to $\frac{1}{4}$ in. A piece of limetree was fitted in the crack loosely and then removed; thin white-lead was rubbed on the strip of wood, and it was screwed in place as shown in the section (Fig. 457). After corking up the screwheads, the roller was as good as new.

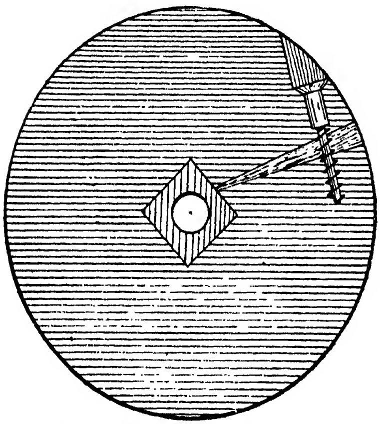


Fig. 457.—Method of Filling Up Crack in Mangle Roller.

Polishing Mangle Rollers.—Shave, say, $\frac{1}{2}$ oz. of beeswax, and dissolve it in sufficient turpentine to form a thick paste. Dissolve $\frac{1}{2}$ oz. of gum sandarach in 5 oz. of methylated spirit. When thoroughly dissolved mix the two and stir well. After smoothing the roller with glasspaper, apply the polish with a piece of clean flannel, while the roller is turning in the lathe or in the mangle, out of contact with anything else, and finish off with a piece of soft cloth. If the first application is not sufficient, more polish can be used when that first applied has been worked into the wood. Another recipe is :—1 pt. of methylated spirit, 2 oz. of gum sandarach, 2 oz. of seed lac, 2 oz. of gum benzoin, and 2 oz. of best beeswax. Dissolve the wax by gentle heat in sufficient turpentine to make a thin paste, then add it to the above after the gums are dissolved and carefully strained. Mix well together, and apply with soft flannel or a wadding pad as used by polishers. If the mixture is too thin, or seems a long time in giving a good result, or is to be applied by means of a camel-hair brush instead of pads, add more seed lac.

Mantel-boards

Fixing Mantel-boards for Curtain Drapery.—When it is desired to drape a fireplace with curtains, a wood mantel-board has to be fixed on the permanent iron or marble mantelpiece. In some cases a plain or shaped board of mahogany or other hard wood is polished, and drapery tacked on the edge independent of the curtains, which are suspended on a rod and rings from underneath. A common deal board may be stained and polished, or covered with leather cloth, art serge, or similar material. Another method is to fix round the edges, instead of the drapery, a moulding of sufficient depth to hide the top of the curtains. This is mostly done with the polished hardwood boards. It may be fixed on the edge as shown by Fig. 458, or on the under side, as in Fig. 459—in which case a smaller moulding may be used, and the board itself moulded. Methods employed in fixing the mantel-boards are shown by Figs. 460 to 463.

Fig. 460 shows a strong screw-eye put towards each end of the board about 1 in. from the back edge on the under side, through which a screw is passed and driven into a wood plug in the wall. Fig. 461 shows a wood turn-button; one of these is screwed on at each end, and another midway at the front. The hook shown by Fig. 462 is more generally used, and is the most expeditious. Fig. 463 shows the method of treating the cast iron mantelpieces often seen in bedrooms of modern-built houses; these mantelpieces being hollow on the under side, all that is necessary is to place a block of wood to catch the point of the hook. For the curtains, a rod of solid $\frac{1}{2}$-in. iron is bent to fit about 1 in. behind the moulding or drapery, and is fixed on hooks (*see* Fig. 464). If preferred, holes may be made in the rod for fixing it on square hooks, as shown in Fig. 465. In this case, it requires to be hammered flat at the ends and midway, to do which it must be heated. The holes may be punched at the same time, or drilled whilst cold. Fig. 466 gives a complete view of the rod.

Maps

Cleaning Varnished Map.—Rub the map with a damp cloth or sponge. Most of the dirt can probably be removed by placing the map on a table and rubbing stale breadcrumbs over it with the palms of the hands.

Mounting Cycling Road Map.—The following is a method of adapting a cyclist's road map, so that it can be carried in the waistcoat pocket. It is presumed that the map measures 22 in. by 17 in. after being trimmed. It should first be ascertained if the margin round the border of the map is even all round; if not, take a pair of compasses, a knife, and straightedge, and square up the map. Next procure from a local draper a piece of white calico, 2 in. larger all round than the map to be mounted. The map should now be cut into sections as shown in Fig. 467. The best way to do this is with a pair of compasses. Divide the space between A and B into eight equal parts. Mark the spaces at the top and bottom of the sheet, and with the knife and straightedge cut the map into strips. Next divide the strips into four equal spaces, to correspond with A to C, so that, after cutting through these latter marks, the map will be in thirty-two sections, and if laid out will appear as in Fig. 467. Then stretch the calico tightly on a smooth drawing board or kitchen table, fixing it round the edges with tacks or drawing pins so that no wrinkles are seen. The sections should be laid out in their proper order previous to pasting. Take the section marked No. 1 in Fig. 467, lay it face downwards on a scrap of paper, and apply a fairly good

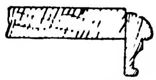


Fig. 458.

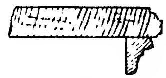


Fig. 459.

Figs. 458 and 459.—Fixing Curtain Moulding to Mantel-board.

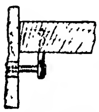


Fig. 460.

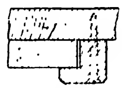


Fig. 461.

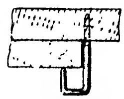


Fig. 462.

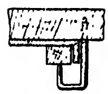


Fig. 463.

Figs. 460 to 463.—Methods of Fixing Mantel-boards.

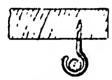


Fig. 464.

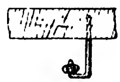


Fig. 465.

Figs. 464 and 465.—Methods of Supporting Curtain Rod.

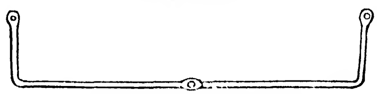
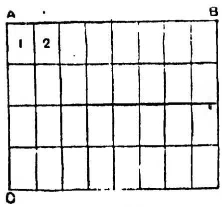


Fig. 466.—Curtain Rod.

coating of flour paste. Each section should, after being pasted, be allowed to soak for a few minutes. When section No. 1 has soaked sufficiently, place it in position on the calico and give it a good rubbing with the palm of the hand. The remaining sections should be treated in the same manner, excepting that between the sections from A to B (Fig. 468) a space of $\frac{5}{32}$ in. must be left, while between those from A to C a space of $\frac{1}{4}$ in. bare should be left. These spaces are to enable the map, when completely mounted, to be folded up. Any paste that

sets on the face of the sections can be washed off with a damp sponge. The map, after being mounted, should be allowed to dry for at least twelve hours; it can be removed by cutting round the outer edge with a knife and straightedge, and should afterwards be folded up. To complete the usefulness of this map, a small thumb case should be made as shown at Figs. 469 and 470. The skeleton of the case consists of a piece of white pasteboard of medium thickness (say 3 or 4 sheet thickness), which should be about ½ in. larger all round



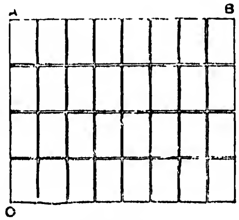
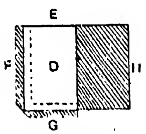


Fig. 467. Fig. 468.

Fig. 467.—Dividing Cycling Road Map for Cutting.

Fig. 468.—Mounting Map in Sections.



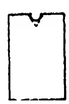


Fig. 469. Fig. 470.

Fig. 469.—Cutting out Pattern for Thumb Case.

Fig. 470.—Thumb Case for Map.

than sections 1 and 2 (Fig. 467). Fold the pasteboard in half, care being taken that the folding does not split the board at the fold. Take the map, which should be folded to the size of one section, place it inside the folded pasteboard, and mark the last mentioned with a pencil so as to allow it to measure ¼ in. larger all round than the map. The skeleton of the thumb case when cut down to these marks will be ready for the outer covering. The best material for the outer covering of the case is a piece of paste grain roan, which can be procured from a local bookbinder, and should be about ¾ in. larger all round than the skeleton. The roan should be cut to the shape of Fig. 469, the shaded portion representing the leather, while the light portion D represents the folded pasteboard. When the leather is cut to shape as shown by the shaded portion in Fig. 469, it should be carefully pared all round the edges, except the top edge E, and then pasted all over the wrong side. After a few minutes it can be placed in position as shown in Fig. 469. The turn-in portions F and G should next be folded to the dotted lines, care being taken that a neat corner is made. The side H should be brought over and carefully rubbed down in position, but care must be taken that the leather in its soft and moist condition is not rubbed too much, or the grain of the leather will be taken out. The thumb case should now be allowed to dry for a few hours, when the top edge E can be trimmed with a knife and straightedge. Then with a gouge cut out a thumbhole on the top edge as shown in Fig. 470, so as to facilitate the removal of the map. Should a gouge not be available, the thumbhole can be made by cutting out a triangular piece. The thumb case should next be washed with a wet sponge and a little paste, and when dry, it can be varnished with bookbinders' spirit varnish applied with a piece of cotton-wool.

Mounting Roller Maps on Canvas.—Large maps, plans, etc., are sometimes required to be mounted on canvas, then fitted on rollers and varnished, in order that they may be either rolled up for carrying about, or hung on a wall. Backed with canvas, a map will stand considerable wear, and varnish will protect the surface. A large board, clamped similar to a drawing board, will be the first requisite. On this stretch a piece of canvas, 2 in. larger each way than the outside size of the map. It is not necessary that all the creases should be drawn out of the canvas—a few flat-headed tacks or drawing-pins may be placed round the edges, or the edges may be glued to the board. When the canvas is ready, lay a sheet of white paper on a level table, place the map face downwards on it, sponge the back until all the stiffness disappears, and give it a moderately thick coating of paste. The paper on which the map is

placed for pasting should, if possible, be free from folds or creases, as these have a tendency to mark the print, more or less. A suitable sheet may generally be purchased at a newspaper printing office; one sheet may be used several times. Remove any lumps that may have accumulated on the pasted map, drop upon it the board, having the canvas attached, and press and rub down from the back. On raising the board, the print will be found adhering, though unevenly, to the canvas. A thorough rubbing down on the face, by means of a sheet of thick paper, over which a clean folded duster is pressed, will expel all air, and cause the map to present a good, flat surface. Should it be found that air blisters still remain, prick each one with a fine needle, and press them down with a duster. After mounting, the map should be left to dry and to stretch out on the board; it may then be coated with strong size in order to stop the suction and prevent any discolouring of the paper previous to being varnished. This sizing must be evenly done, as any portion missed will develop into a brown stain on application of the varnish. When the sizing is dry, thinly coat the print with best paper varnish, using a wide, flat, hog-hair brush. Lastly, trim off the superfluous canvas, and fit the map with rollers. To fasten a roller to a map, glue the edge of the map about ½ in. on; when the rollers are of heavy, hard wood, drive tin-tacks through the canvas at the back as an additional support. Ordinary picture-frame rings may be screwed into the top of the wooden rollers for the map to hang by, or a tape may be tacked on the back of the roller.

Restoring Old Map.—Assume the case of a very old map which has been partly crushed and folded on itself. By carefully carrying out the following instructions, the map will be preserved for many years. Get a piece of white calico a little larger than the map all round, lay this down on a flat board, and drive in tacks closely along two edges (drive in the tacks only just sufficiently to hold the calico, so that they can be easily pulled out again). Having finished two edges, tack the other two, pulling the calico well to stretch it, and keep it perfectly flat. Leave this now and take the map, spread it out flat into a vessel of water, and allow it to lie till perfectly soft. If the map has been already mounted on cloth, it must lie long enough in the water to be separated without any strain. Leave it in the water, and with good flour paste and a suitable brush paste the calico as it lies on the table. Then lift out the map, and, having removed the superfluous water from both surfaces with blotting-paper, lay it carefully on the pasted cloth, put a piece of paper on top, and rub carefully with the hand, working from the centre outwards. This, if carefully done, will make the map practically everlasting. If any little holes have been made at the fold by pieces breaking away, small pieces of white paper can be let in, and when dry, lines which have been broken can be mended with Indian ink. It will not matter if the map has broken away in several pieces; the task will be rendered easier, as small pieces are better to handle, and these can be pasted instead of the cloth and laid carefully down, making sure that the right pieces come together, and that the lines join properly.

Marble

Almost any stone susceptible of a fine polish is called marble, but, strictly, marble is a limestone and consists of an aggregate of granular crystals of calcite. Many marbles have fossils embedded in them.

Cementing and Mending Marble.—The following information refers to the mending of marble slabs of washstand tops and backs, mantelpieces, etc. (1) If the mantel is of white marble, use fine plaster-of-Paris mixed to the consistency of thick cream. A thoroughly satisfactory job, however, cannot be made, as the repair will show in time. (2) For black or coloured marble, use brown or orange lac, obtainable from drysalters or chemists. Warm the broken pieces of marble before the fire, then place on the lac, and when melted press the two pieces together until firmly set—a few minutes will suffice; the superfluous lac should be squeezed out whilst it is warm. If desired, the lac may be prepared in sticks by melting it on a hot plate, adding

the requisite colouring matter in the shape of oxides, and then rolling into sticks similar to sealing wax. An ornamental support may be refixed in place by plaster-of-Paris. (3) For putting together the parts of marble tops of washstands, etc., mix intimately 4 parts of finely powdered plaster-of-Paris and 1 part of finely powdered gum arabic; then with a cold solution of borax make into a mortar like paste. Use the paste as a cement. Leave the cemented parts for several days undisturbed to allow the cement to set thoroughly. (4) Another recipe for the same purpose as No. 3: Take chippings of white Portland stone and crush into a fine powder. Dissolve $\frac{1}{4}$ lb. of white shellac in $\frac{1}{4}$ pt. of methylated spirit at a temperature of 70°. Mix together the powdered dust and the liquid shellac to the consistency of thin cream, and apply to the joint. Remove the superfluous cement from the face of the marble and allow to stand undisturbed for twenty-four hours.

Cleaning Marble.—If the marble is not much discoloured, it may be bleached by treating with a solution of soap lye and whiting. Mix the soap lye and whiting to the consistency of paste, and apply a good coating with an old brush. Let the paste remain on the marble for a couple of days, then wash off with clean water (rain water for preference), repeating the process two or three times until the marble is clean. To make the lye, dissolve say 7 lb. of American potash in a pailful of water. Should any of the liquid get on the hands, they should be at once well washed in water containing a few drops of vinegar or acid, as the lye is dangerous to fingers and nails. Should this method of bleaching be ineffective, the marble had better be "gritted," that is, rubbed with grits of varying degrees of fineness, beginning with the coarse stone (Harehill or Robin Hood), next the second grit or pumice-stone, which is a little finer, and finishing off with snakestone or water-of-Ayr stone. Each of these grits must be used with water. Care must be taken that in each process of gritting, the marks or scratches of its predecessor are removed, so that when the surface is snaked, no scratches whatever are visible. To remove stains from marble cases, clocks, dials, etc., take equal parts of fresh oil of vitriol and lemon juice, shake up these very thoroughly in a bottle, wet the spot with the mixture, and a few minutes afterwards rub with a soft linen cloth. Probably the spots will then be found to have disappeared.

Cutting Marble.—Marble is cut by drawing the saw—a plate of iron or mild steel, the cutting edge of which is kept slightly indented—backward and forward in a shallow cut, formed on the face of the marble with a chisel and hammer, fine sharp sand and water being continuously fed into this. The blade is held nearly parallel, and pressure is applied from above (in the case of large blocks, the weight of the saw—which is fastened in a frame—is partially counter-balanced by a weight hung over a pulley). Practical directions on cutting a white marble slab which is 1 in. thick, 18 in. wide, and 55 in. long, are as follow: Make a grub saw with a piece of hoop iron about $1\frac{1}{2}$ in. to 2 in. wide, and 14 in. to 18 in. long. One edge of the hoop iron must be made jagged or roughly notched; the other edge must be inserted and wedged in a saw-cut made in a strip of wood about $1\frac{1}{2}$ in. to 2 in. square, or 2 in. thick if round in section. A piece of a very thick broom handle would do. Place a board by the side of the line on the slab where the cut is to be made, and load the board with weights to keep it in position. Thoroughly wet the slab, and sprinkle some clean sharp grit or sand on the line, and then rub the saw to and fro by the side of the board. The slab must be constantly re-wetted and more sand sprinkled in the groove made by the saw; con inue this until the slab is cut through.

Drilling Marble.—It is possible to drill a hole in marble by turning a chisel between the hands, but a marble mason uses a special drill provided with bits of various sizes.

Polishing Marble.—Rub the surface of the marble with grit stones of varying degrees of fineness, beginning with the coarse or first grit (Harehill or Robin Hood), next the second grit which is a little finer, finishing with snakestone or water-of-Ayr

stone. As has already been stated, in each process of gritting the marks or scratches of its predecessor must be removed, so that when the surface is "snaked" it is quite smooth, no scratches whatever being visible, for on the careful gritting depends the success of the ultimate polish. The marble is now "emeried," which is done as follows. An old cotton, or, better, a worsted stocking, is rolled up as tightly as possible into a wad or boss about 3 in. in diameter; one of the ends is wetted, dipped into fine flour emery, and well rubbed over the surface until the shine begins to appear. Finally, a wood block on which is fastened a piece of thick felt, moistened with water and sprinkled with putty powder, is rubbed up and down vigorously over the surface of the marble until the gloss or natural polish is obtained.

Removing Grease Stains from Marble.—It is almost impossible to get all the oil out without injuring the marble. A portion can be extracted by thoroughly washing the slabs, and then coating the stained parts with slaked lime and potash, applied when hot. Allow this to remain for a day or two, and then wash it off and repeat the process. No acids of any kind should be used, as they will destroy the marble.

Stopping for Cracks in Marble.—Stopping for coloured marbles is made from brown shellac, which is obtained in the form of flakes or shells. The lac is put on a hot plate which is only just warm enough to melt it slowly; care must be taken that the plate is not too hot, or it will burn the lac and spoil it; the heat to the plate is usually adjusted with gas-jets of the Bunsen burner type. When melted, and while still on the hot plate, the lac should be thoroughly mixed with a brass or steel spatula. For colouring matter, use (a little at a time) ordinary painters' dry colours in powder, knead all well together until incorporated and the desired tint has been obtained. A little putty powder (oxide of tin) may be added to lighten the colour of the stopping if necessary, and also to harden it. The composition may now be rolled out on a cold slab and made into sticks. To use the stopping, the defective place in the marble must be made just hot enough to melt the composition, a blowpipe being sometimes employed for this purpose. The stopping should be pressed in with a copper bit, smoothed over, and afterwards "gritted" off preparatory to polishing.

Marine Glue (*see* Glue)

Mask

(1) In making a mask, first prepare a box of wood 1 ft. square and 8 in. deep. Mix together, dry, equal quantities of whiting and plaster-of-Paris, and then make it into a thin paste with cold water. With this fill the box and allow it to dry thoroughly. Then, with a pointed knife, dig out the centre of the composition, cutting and forming the features of the mask; scrape and clean the mould quite smooth, and, when this is satisfactorily finished, paint it over with shellac varnish. Next make some good flour paste, adding a little liquid glue. Tear some stout brown paper into pieces about 3 in. square, put these to soak in cold water, and then squeeze all the superfluous water out of them. Well paste each piece on both sides, and place them one on the other to keep them moist. Next rub over a piece of tissue paper with sweet oil, and place this inside the mould, pressing it into the features. Press the pieces of pasted brown paper piece by piece well into the mould, building the mask up to the top edge. Continue this until three or four thicknesses of paper have been applied; then press and smooth the whole with the fingers and allow to dry, when the mask may be turned out of the mould. Give the mask a coat of white oil paint, adding a little Venetian red. To make this, get ½ lb. of white-lead, a little boiled oil and turps, and a few drops of gold size, adding then the tint of Venetian red. When dry, the mask may be painted as wished, and the front part of the mask is complete. A barber's block should now be used for the back part. Get a stout piece of white linen canvas, place the selvage edge over the centre of the block to lie 1 in. over the front half of the mask, then crease it and cut to fit the block, of course leaving it large enough to pass over the head. Glue the

overlapping parts together, and glue together the front and back of the mask. A piece of tape may be run in at the neck to draw it to the head. The canvas should be painted to correspond with the front. Rabbit skin or wool may be glued on for the hair, but if a bald head is required, add a little copal varnish to the paint. (2) First prepare a model in clay; mould it on a board with a few home-made clay-modelling tools, and then cut and trim until the head is to the maker's liking. Now box the clay in with strips of board about 1 in. higher than the face, mix some plaster-of-Paris, and pour it into the box. When it is set, knock away the wood, dig out the clay, and a perfect mould results. The paper mask is made as described in instructions No. 1.

Massicot (*see* Litharge)

Mastic Cement (*see* Cement)

Matting Acid (*see* Acid, White)

Mattress

Cleaning Wire Spring Mattress.—The only effective treatment for a rusty spring mattress is to have the wire webbing re-tinned or galvanised. The rust is caused through the previous coating of tin on the wire having perished. Take off the wood plinths at the ends of the frame, and knock out the clout nails by which the webbing is secured to the cross-bars. Then have the wire tinned.

Fitting Up a Wire Spring Mattress.—When a spring mattress is made at the factory, it is not usually put together ready for use, but is rolled up, and the two sides are tied up with it; the whole of the parts of the mattress are then enclosed in a piece of canvas, and sewn up, so as to reduce the bulk as much as possible. Packed in this way, it is less liable to damage. This canvas wrapping, when received, will be found to contain two long pieces of wood forming the sides; one shorter piece, called the "fast piece"; the wire mesh, with a piece of wood secured to each end; and a parcel containing the necessary bolts and a key, consisting generally of four 4-in. or 6-in. by $\frac{1}{2}$-in. bolts and nuts, and two 8-in. or 10-in. by $\frac{5}{8}$-in. coarse-thread bolts and nuts, and a mattress key, which serves the double purpose of screwing up the hexagon nuts on the $\frac{1}{2}$-in. bolts and the $\frac{5}{8}$-in. bolts as well. Having got all the parts together, and the bedstead ready for the mattress, first of all put the sides (which are usually fitted with a small iron catch screwed on the inside) across the bedstead with the catches inside, taking note which end of the sides is for the head, and which for the foot. In the cheaper makes there is sometimes no difference, the sides being parallel all the way along; but in the better class of mattress, the side is raised at each end about 3 in. or 4 in. The head of the sides can be distinguished from the foot by the greater length of the raised portion at the end. The object of these raised pieces is to prevent the mattress, when stretched, from touching the sides, thereby adding to comfort in use. The sides having been placed in position, take the single piece of wood referred to as the fast piece, and bolt it firmly with two of the $\frac{1}{2}$-in. bolts through the end holes on to the sides, at the head. Next take the square nuts off the two $\frac{5}{8}$-in. bolts, and slip the bolts into the holes in the end piece, in which they should turn easily. Examination of the pieces of wood on the mattress will show that one piece has got two holes at the end only, while the other piece has got two at the end and two nearer the middle for receiving the $\frac{5}{8}$-in. bolts. The piece with the two holes is for the foot, and is to be bolted on to the end of the sides in the same manner as the piece at the head. Having got so far, the rest will be easy. Pull the mattress straight, until the holes in the piece of wood on the mattress are in a line with the $\frac{5}{8}$-in. bolts, already inserted in the end piece of the frame, and then fix the key or handle, as it is called, on to the head of one of the $\frac{5}{8}$-in. bolts. Holding up the mattress as close as possible to the bolt or screw, give a few turns, so as just to give the screw a start; then give the other one a few turns and a start; and go on winding each alternately until the mesh is sufficiently tight. It is best not to wind it up too tight at first, as after a little use it will soon begin to sag; but with a little experience it will soon be found at what tension to leave it. Having tightened it

up, put the square nuts on to the screws projecting through the end piece of the mattress. With a little handling, the mattress can then be lifted up and placed in its proper position on the bedstead, with the tension screws at the head. When the mesh begins to sag, it will be an easy matter to pull the bed away from the wall, and give the screws a turn or two, without taking the mattress off the bed.

Meat Cloths

Boiling water only is not sufficient to remove the grease from dirty meat cloths. Soap and water may be employed, but the best plan would be to use caustic soda —4 oz. to 8 oz. to the gallon of water. The cloths may be boiled in this, removed, and well rinsed in clean water. The boiling may be carried on in an ordinary washing boiler, and the solution can be used as long as it proves effectual, after which it must be thrown away and a fresh solution prepared. The commercial caustic soda can be obtained in tins at about 6d. per pound.

Meat Hooks

For making butchers' meat hooks, procure a round rod of iron of the requisite diameter. Having made a wire template of the hook, cut off the iron to the required lengths. Point both ends on the anvil. Make a curve of strong flat iron of the shape for the half circular ends, say $1\frac{1}{2}$ in. by $\frac{3}{8}$ in., to fit in the hole of the anvil. Now make the rods red-hot and turn on this curved mould. If the hooks are required bright, file them smooth and finish with emery paper.

Meerschaum

Meerschaum is found in best quality and most abundant quantity in Asia Minor, though it also occurs in Greece, Spain, Moravia, Morocco, and South Carolina. The richest mines are on the plains of Eskishehr, 250 miles south-east of Constantinople; one of these mines is said to be a thousand years old and consists of about 2,000 pits within an area of six miles, all but about 150 of which have been exhausted. The mineral occurs in nodules of various and irregular sizes, buried in the alluvial deposit of the plain. Another mine comprises 3,000 pits, only 100 of which are being worked. The material is mined by the inhabitants of the surrounding villages and transported in the rough to Eskishehr. The meerschaum is soft when mined, but soon hardens when exposed to the air. For this reason the lumps are roughly scraped off at first and then laid aside to dry. When dry, they are scraped and cleaned, and then finally waxed and polished. The lumps are now sorted according to size into four classes and packed in boxes labelled L., G.B., K.B., and K.P., for the German words, Lager, gross Baumwolle, klein Baumwolle, and Kasten polirt, Lager being the largest size. In this condition the meerschaum is shipped to the pipe manufacturers. Information on the working, repairing and cementing of meerschaum is given under the main heading, "Tobacco Pipes."

Mercurial Barometer (*see* Barometer)

Mercurial Water

Mercurial water is prepared with 10 parts of mercury and 11 parts of nitric acid (specific gravity, 1·33) poured on it with the necessary precaution. It is allowed to repose until all the mercury is dissolved, then shaken vigorously, and 540 parts of water added.

Mercuric Chloride

The material commonly known as corrosive sublimate, and frequently mentioned in this book, is mercuric chloride, the chemical composition of which is expressed by the letters $HgCl_2$. It may be produced by dissolving mercuric oxide in hot hydrochloric acid; another way is to heat mercury in chlorine gas, when the metal burns, producing the mercuric chloride. A better way is by subliming mercuric sulphate and dry common salt, mixed in equal proportions. By the method first mentioned, crystals of the material separate out on cooling. Corrosive sublimate dissolves in about 3 parts of hot water or 16 parts of cold water; it melts at about 260° C., and has strong antiseptic qualities. Owing to the latter it is used in some methods for preserving timber, cordage, etc.

Mercury

Metallic mercury, commonly called quicksilver, has been found in great abundance and purity in Australia and California; it also occurs native in cinnabar, a sulphide, in Spain and Austria. It is a very bright liquid at ordinary temperatures, silver grey in colour, and it boils at about 360° C., volatilising at all temperatures higher than about 20° C., however. It turns to the solid state when cooled to —40° C. In cooling, mercury contracts very considerably, the density at 15·5° being about 13·6, while, when frozen, it is about 14, water being of density equal to 1. To obtain the metal the sulphide is either roasted in a furnace or heated in an iron retort with scrap iron, lime, etc. The vapours are led away to a large chamber, sulphurous oxide escaping, and the mercury being condensed. Hydrochloric acid and dilute sulphuric acid have practically no effect on mercury, but hot, concentrated sulphuric acid oxidises the metal. Dilute nitric acid dissolves the mercury freely. Mercury is largely used in the arts and in medicine; amalgams (alloys of mercury and gold, silver, tin, lead, etc.) are often employed. The adulteration of mercury with tin or lead may be known by the streak left behind when a globule rolls along a table, or by the dull surface of the mercury when shaken in a large bottle with air.

Amalgams.—Mercury readily amalgamates with another metal chemically clean. The chief example of interest to the handyman is in the preparation of zinc plates for use in primary batteries. The zinc is cleaned by dipping into dilute sulphuric acid or hydrochloric acid. A few drops of mercury are poured on and rubbed well in by means of a linen rag fastened to the end of a short stick; or, instead, when many zincs are to be treated, they are cleaned in the acid, as above, and then left in the mercury for a time.

Collecting Spilled Mercury. — Mercury spilled on a table is somewhat difficult to collect, unless special precautions are taken, owing to its tendency to divide into small globules which roll away at the slightest touch. "Technics" says that if a wet ring is made round the spilled mercury by the aid of a wash-bottle or other similar means, it will be found that the globules of mercury cannot readily cross this ring; the mercury can then be easily collected in a small shovel made from a piece of thin card, or even in an ordinary envelope.

Filling Tubes with Mercury (*see* Barometer).

Purifying Mercury.—For purifying mercury, a simple arrangement, described by Messrs. G. A. Hulett and H. D. Minchin in the "Physical Review," is to distil the mercury in a Wurtz flask under diminished pressure, allowing bubbles of air to pass through the liquid during distillation so as to prevent bumping. The air oxidises any metallic impurity, such as zinc, cadmium, or lead, which otherwise would contaminate the distillate. Ordinary distillation *in vacuo* of mercury containing one of these metals does not suffice to remove the impurity; but by means of the method here described an amalgam of zinc can be made to yield pure mercury in a single distillation.

Metal Polishes

Metal Polishes containing Chalk.—(1) The following has been given as a good liquid metal polish: 4 oz. of prepared whiting, 4 oz. of paraffin, 6 oz. of clear oil, and 1 oz. of oleic acid. When thoroughly mixed, add a little oil of mirbane to perfume if so desired. (2) A good liquid metal polish consists of prepared chalk 8 oz., turpentine 2 oz., strong ammonia ½ oz., and spirit of camphor ½ oz. Rub this on, and when nearly dry polish with a soft flannel. Another good polish simply consists of prepared whiting and turpentine mixed to the consistency of cream. This polish will last much longer than the ordinary pastes. (3) The following will be found well adapted for cleaning brasswork: Oxalic acid 2 oz., turpentine 2 oz., benzine 4 oz., and liquid ammonia 2 oz. Well mix these, and when the oxalic acid is dissolved add 4 oz. of best prepared chalk and thoroughly shake up. Apply with a sponge, and allow to dry before polishing. All crevices should be got into by means of a small plate brush.

(4) The following paste is equal to a much advertised polish. Take some best powdered whiting, and mix this with paraffin to a stiff paste; then add a little vaseline, and finally scent the whole with a small quantity of perfume to hide the smell of the paraffin. (5) Mix together 1 part rouge and about 2 parts whiting, and place in a large vessel with water; the solution is allowed to settle, and, while still liquid, poured into moulds, dried, and packed. (6) The following answers very well for cleaning plated and other articles. Take $\frac{1}{2}$ lb. of best prepared chalk, 3 oz. of turpentine, 3 oz. of benzene, and 1 oz. of liquor ammoniæ, and thoroughly mix together. Shake the bottle well before using, and apply with a sponge, allowing the mixture to dry before rubbing with a flannel to polish. (7) An excellent and simple liquid metal polish is made up of $8\frac{1}{2}$ lb. of finely sifted Spanish whiting, $2\frac{3}{4}$ gal. of petrol, and 1 oz. of oleic acid; the whole should be well shaken up. The whiting will be found suspended in the liquid, and is not very liable to settle. The liquid may be used from a sprinkler or a common bottle in the ordinary way.

Metal Polishes containing Rottenstone, Crocus, etc.—(1) Mix together 3 parts of rottenstone, 2 parts of flour emery powder, and 1 part of crocus in boiling mutton suet; this will make a stiff paste. Or good sweet oil may be used instead of the mutton suet. (2) Mix rottenstone in oil to a thick paste and add a little crocus. (3) Mix together $\frac{1}{2}$ oz. of rottenstone in fine powder and $1\frac{1}{2}$ oz. of best jewellers' rouge; then add 1 pt. of good paraffin, and scent if desired with oil of mirbane. This is, of course, a liquid polish, and must be well shaken before being used. (4) Polish made as follows may probably meet most requirements. Mix thoroughly together 2 oz. of oxalic acid, 1 lb. of powdered rottenstone, 1 oz. of powdered gum arabic, and 4 oz. of linseed oil, adding sufficient sweet oil to make the mixture of the desired consistency. (5) A liquid polish for metals, recommended by an authority, is made by mixing together 20 parts of peroxide of iron (jewellers' rouge), 20 parts of pulverised rottenstone, 20 parts of pulverised infusorial earth (kieselguhr), 1 part of oxalic acid, and sufficient palm oil and vaseline to hold the powders in suspension, with sufficient oil of mirbane for perfuming purposes.

Other Metal Polishes.—(1) A polishing paste for metals, useful when a delicate surface is to be polished without scratching, is made by dissolving 16 parts of soap, cut in small pieces, in the smallest quantity of water possible, on a water bath. Before cooling, add a hot solution of 2 parts of precipitated lime, 1 part of jewellers' rouge (calcined oxide of iron), 1 part of cream of tartar, and 1 part of carbonate of magnesia. The whole is mixed until perfectly homogeneous, and a little water is added, if necessary, so as to form a paste. This is run into a rather shallow box, and afterwards put up into tubes. (2) A polishing stick may be made by mixing tripoli and rottenstone with Russian tallow. Melt the tallow and well stir in the tripoli till the whole is of the consistency of a stiff paste, set aside to cool, and then compress; this hardens the mass and allows of its being handled and easily used. For fine polishing, make the stick with putty of tin or crocus powder. (3) A new metal-cleaning composition, protected by patent, is a solution of 1 oz. of potassium carbonate, $\frac{1}{2}$ oz. of potassium cyanide, $\frac{1}{2}$ oz. of sodium carbonate, and $\frac{1}{10}$ oz. of sodium chloride in 1 gal. of pure water. It is used whilst boiling, and a strong electric current employed; the gas which is formed immediately separates all grease and other impurities from the metal, leaving it chemically clean.

Methylated Spirit (*see* Alcohol)

Mica

Mica is an anhydrous silicate of calcium and aluminium, and crystallises in a laminated mass, easily split along its axis; it can be subdivided down to $\frac{3}{100000}$ in. in thickness. Deposits of this material are found in various parts of the world. The best quality mica is obtained from India. These mines, the principal of which is the Abruker mine, are in the interior of the country, remote from civilisation, and extremely inaccessible. Here the deposits

are worked now as they were 2,000 years ago. No machinery of any kind is used; drills and hammers are the only tools employed. The refuse and the mica are placed in baskets which each hold about 10 lb., and which are passed up from hand to hand by women who stand in a line on a ladder. When the top is reached the baskets are dumped and returned down the ladder in the same manner, but by another line of women. The crude mica is first roughly trimmed and then sorted into different grades, according to sizes and qualities. It is then split up, and the size to which it is to be sheared is marked upon it. The cut pieces are next cleaned, weighed, and packed, ready for transport. At the Abruker mine, the packages of mica are loaded into carts, drawn by bullocks, and carried in this way to seaports hundreds of miles away; the bullocks travel at the rate of about ten miles a day. There are many kinds of mica. The three commercial varieties of mica are the white or potash mica (muscovite), yellow or magnesia mica (phlogopite), and black or iron mica (biotite), but there are no hard-and-fast lines, and they shade into each other. The last is the commonest, and generally is excellent for electrical purposes when not marred by specks and streaks, which absolutely destroy its usefulness; it is of no use for glazing and grinding up. The yellow mica (which includes the "amber mica" of the trade) is fairly well adapted and much used for glazing, for which potash mica is particularly suited, though it is too hard and brittle for most electrical uses. Oil-stove windows are glazed with mica. The infusibility of mica at ordinary heats is a known fact. Before the blowpipe some of them, especially the lithia micas, are fusible with difficulty, yielding up a portion of their water. A very intense heat, as that of the electric arc, will cause the mica to whiten and crumble locally, and even a low degree of heat sufficiently prolonged, as in a stove or furnace wall, causes the

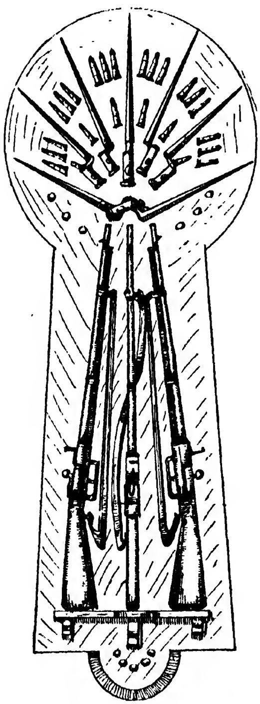


Fig. 471.—Infantry Trophy.

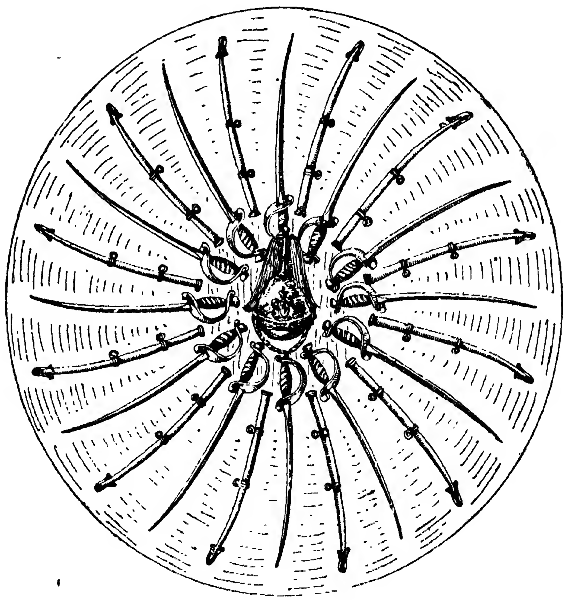


Fig. 472.—Cavalry Trophy.

mica to lose gradually its elasticity and to become brittle and friable.

Cement for Mica.—(1) Mica may be cemented by moistening the edges with a solution of gelatine in strong acetic acid. (2) Another cement for mica is made by soaking gelatine in cold water and pressing out excess of moisture in a cloth. Then heat it on a water bath until it begins to melt, and stir in alcohol to form a fluid. For each pint of solution, gradually stir in $\frac{1}{4}$ oz. of gum, and $1\frac{1}{3}$ oz. of gum mastic previously dissolved in 4 oz. of rectified spirit. Keep in stoppered bottles and warm when required for use. (3) Grind extremely fine, 1 part of glass and 2 parts of fluor spar, then make the mixture into a paste with a strong solution of soda-water-glass. Apply as quickly as possible, as the cement sets very rapidly. This resists heat, and is an electric insulator. (4) Use 5 parts of finely powdered glass, 4 parts of borax, 8 parts of amorphous silica, and 200 parts of zinc oxide. This cement, just previous to use, should be made into a paste with a strong solution of zinc chloride, and applied quickly. It will take some time to set, but hardens like stone.

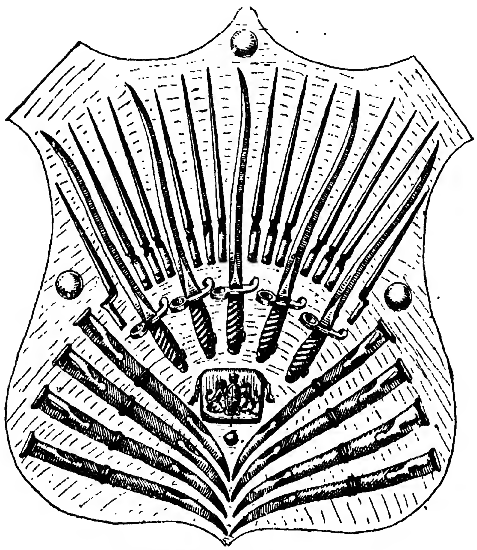


Fig. 473.—Artillery Trophy.

Military Trophies

The designs given by Figs. 471 to 474 show the arrangement of various weapons to form military trophies for wall and ceiling decorations, and the weapons have been so arranged as to represent respectively one of the branches of the Service. The arms may be equally well adapted to one or other of the shapes shown. The background should be of dry wood 1 in. or $1\frac{1}{4}$ in. thick, the pieces being carefully fitted and fixed together; if to be stained or varnished, the background must be planed well, cut to shape, and then varnished if a light colour is wished, or stained and varnished if a dark colour is preferred. The bright steel swords or bayonets will show well on either, or the wood may be covered with cloth of suitable colour, as red, marone, or dark green, stretched over and

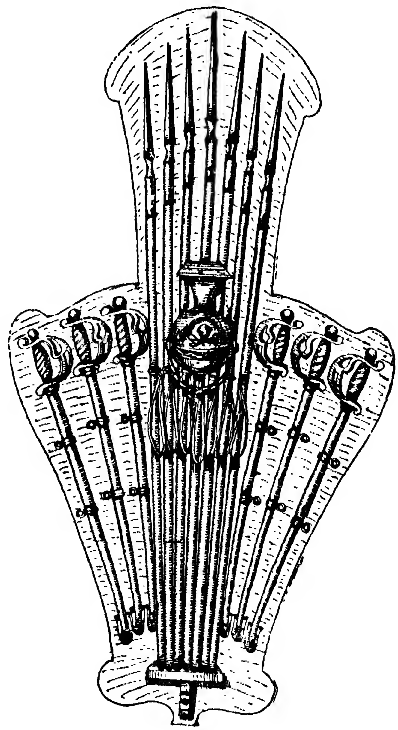


Fig. 474.—Lancer's Trophy.

fastened round the edge with brass-headed nails if a bright effect is wanted, or with ordinary large-headed black tacks. The weapons may be secured in two ways:—First, when the weapons are arranged, to see what shape of clip will be suitable make a little pattern in wood, and then have castings made in brass and polished. These clips should fit over the weapons and have a flat piece at each end with a hole for a screw, by which they would be screwed to the background, and a pattern would be required for each weapon. A simpler method would be to obtain some brass strip, say ¼ in. wide by No. 18 or No. 19 B.W.G. in thickness, and have the front face polished. Then when the various weapons are in position on the background, cut the strip in lengths, bend them over to the shape of the weapon, and leave a flat piece at each end through which a hole may be drilled. Different weapons of course will require brass clips of different sizes. Fig. 472 shows a cavalry trophy mounted on a circular background in sunflower fashion. In the centre is fixed a dragoon's helmet, and radiating from this are dragoons' swords with the handles inwards, scabbards alternating with the swords. This arrangement will give a very brilliant effect of light and shade. An alternative pattern may be made by fixing the swords with the handles on the outside. Fig. 474 shows a Prince of Wales's Feather design, and this is arranged as a lancer's trophy. The lances are fixed in the middle, resting on a shelf screwed to the background at the bottom and with a lancer's helmet in the centre. On each side are arranged the swords, sheathed and with handles upwards. This may be equally well arranged as an infantry trophy, using rifles in place of the lances and with ordinary bayonets at the head of the design and sword bayonets below at the sides. Fig. 473 shows the weapons formed on a shield-shaped background. This is arranged with short sword-bayonets as an artillery trophy. In the centre of the bottom of the shield is fixed an ammunition pouch, round which the steel-mounted, black leather sheaths of the sword bayonets are arranged. Over these, and radiating from the central pouch, are placed the sword bayonets with the handles inwards, and between them some ordinary bayonets increase the brilliancy of the trophy. Fig. 471 illustrates an infantry trophy. The background has a circular top, around which are fixed the ordinary bayonets radiating from a centre and occupying two-thirds of a circle, while between the bayonets are fixed cartridges. Under these, in the long portion, are fixed three rifles, one on each side, placed flat on the background, and the centre one with the top edge to the front. These must rest on a small shelf, which is screwed at the bottom. An alternative plan would be to place the rifles the other way up. A cavalry trophy may be equally well made on this background by placing a helmet at the base of the shield and letting appropriate swords and scabbards radiate from it as a centre.

Milk

Sterilising Milk.—The bottles used in sterilising milk are of thick glass, and are provided with air-tight stoppers and wire fastenings to hold the latter in place. The bottles are about three parts filled with the milk, the stoppers being put in and securely fastened. They are then placed in a shallow boiler filled with water and heated to boiling point for about an hour.

Milk, Testing (*see* Borax).

Minium (*see* Red Lead)

Mill Bills and Picks (*see* Hardening and Tempering)

Mirrors

Mirror which is Transparent from the Back.—The following details relate to a process, patented in Germany about 1895 or 1896, for making a mirror which reflects on one side but is transparent from the other. Make solution A by dissolving 1 grain of silver nitrate in 10 minims of distilled water. Make solution B in the same proportions but in greater quantity, adding, drop by drop, whilst stirring constantly, ammonia water till the precipitate which forms at first is again dissolved. Now gradually add just enough of A to B to dispel all odour of ammonia, by which it will be again made very cloudy in appearance. For every grain of

silver nitrate dissolved in making solution B add 100 minims of distilled water. Then filter till clear and label this solution C. Dissolve in another bottle 8 grains of Rochelle salts in 3,840 minims of distilled water. Boil this, and add gradually, whilst it is boiling, a solution containing 3 grains of silver nitrate to 10 minims of distilled water. Filter when cool, and label this D. Make the glass surface chemically clean, a condition ascertainable by breathing upon it, when, if sufficiently clean, no break or blemish appears when the breath condenses. Lay the clean glass on a piece of white paper, spread on a level surface in a room at 77° F. Into a measure put equal parts of C and D, and pour the mixture over the glass. By watching the white paper the moment for stopping the deposition can be ascertained. The glass is then to be rinsed thoroughly in distilled water and allowed to dry whilst standing on edge. The silvered side must now be varnished with clear shellac, backed with a second clean sheet of glass, and framed.

Preserving Mirrors.—On no account must mirrors be placed against damp walls; and when a room has been repapered, it should be allowed sufficient time to dry before the mirror is put up. To guard against the effects of dampness, cut four slices, about $\frac{1}{4}$ in. thick, from an ordinary bottle cork, and tack them on the back of the frame, one at each corner, so as to allow a passage of air between the wall and the mirror when fixed. This is especially necessary when the outside of the wall is directly exposed to the weather, or where there is danger from a leaky rain-spout. Mirrors affected by damp show small specks through the silvering; these, if neglected, gradually enlarge into blotches. The mischief increases with delay, for not only will the silvering be destroyed, but the glass itself may be rendered unfit for resilvering by the mildew eating into the surface. The glass is more easily scratched than one would imagine. For polishing, soft clean cloths only should be used, and the dust should previously be lightly wiped off. Glasspaper must never be employed to remove spots of any kind. Turpentine will clean off paint spots, and for varnish or polish methylated spirit may be used, while warm water and soda will remove grease. In using liquids, even pure water, care must be taken that it does not run, and so get behind the glass. For general cleaning, a little spirit of salt in the water will be beneficial.

Re-silvering Mirror (*see* Silvering Glass).

Removing Spots from Mirrors.—There is no practicable method of removing marks caused by damp upon a mirror glass. The spots can be prevented from becoming larger by taking the glass out of the overmantel, removing any damp colour, and applying one or more coats of good oil or varnish paint to protect the silvering. Should the silvering peel from the glass, the spots, if not large, may be covered with silver leaf, using weak isinglass size as a mordant, but the best course would be to have the glass resilvered.

Swing Looking-glasses Hung out of Balance.—It has been suggested that the reason for the annoying custom of hanging these glasses out of balance so that they fall forward is the same as that which accounts for door-knobs falling off, window blinds getting loose, etc.—namely, that the makers are too indifferent and too careless to improve upon the usual methods. Of course, the direct cause of the mirrors falling forwards is that the screw is placed behind the heavy plate glass, instead of in front, where it could just as easily be placed, and consequently the tendency is for it to get underneath. It is said that the chief reason for swing looking-glasses being hung out of balance is that the movements or pivots are arbitrarily designed for a normal solid wood framing without the glass. The distance from the screw heads to the centre of the pivot is about $\frac{1}{2}$ in., which for a frame only 1 in. thick would be right; but the weight of the bevelled plate is all on the face, and as many mirror frames are made as shown at Fig. 475, with a side veneer A and a face bead B, $\frac{1}{8}$ in. solid, more weight of this hardwood, compared with the deal frame C, is thrown forward, while the $\frac{1}{4}$-in. pine back board D, brought out to the face of the side veneer to hide the deal, throws the movement still farther back, thus aggravating the imperfect balance. Fixing the

ordinary movement obtainable brings the centre line of the pivot at E, whereas the true balance line would be about F, and dangerously near the face of the frame, also involving a specially deep movement or unsightly sinking. A remedy is to take off the back board and fix pieces of sheet-lead evenly to its under side to counterbalance the weight of the plate glass. In original construction, the glass could be set back centrally in the frame by a small mould G, as shown in Fig. 476, but this would tend to spoil the effect of the bevel on the plate. The small blocks H are for holding the plate glass J in position.

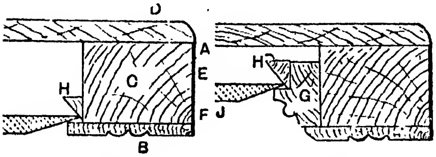


Fig. 475. Fig. 476.

Figs. 475 and 476.—Part Sections of Swing Looking-glasses.

Modelling Wax (*see* Wax)

Moleskins (*see* Skins)

Moths

Keeping Moths from Upholstery.—The cause of moths eating upholstery coverings is dampness or imperfect ventilation. Upholstered furniture should be kept dry. Sprinkle powdered camphor on the chair seats, and let it remain for some time; or place a shallow dish full of strong ammonia under the infected parts. Rub the chair frame frequently with furniture polish which has a turpentine basis.

Prevention of Moths in Furs, etc.—For the prevention of moths and other insects attacking fur, etc., there is nothing better than albo-carbon (naphthalene), but it is useless for the extermination of the insects in any stage of their development. Colocynth, red pepper, Russian tansy, and camphor are also used, but are not so effective, though often preferred, as they have no unpleasant smell like the naphthalene. Where the insects are already present, they may be exterminated by drenching the article with benzoline in which a small proportion of naphthalene has been dissolved (the spirit will quickly evaporate on exposure to the open air, leaving no smell behind); or the goods may be placed in an air-tight box and subjected for two or three days to the fumes of carbon bisulphide. A recipe for a moth preventative, given in a German paper, is the following:—Mix together in the order mentioned, 10 parts of naphthalene, 10 parts of carbolic acid, 5 parts of camphor, 500 parts of spirit, 5 parts of essence of lemon, 2 parts of thyme oil, 2 parts of lavender oil, and 2 parts of sabine oil. By spirit is probably meant pure alcohol. (*See also* Taxidermy.)

Moth Trap.—The contrivance here described can be used with any lamp which will be available for giving light at the same time; lamps that burn with the wide-mouthed chimney are most effective, as they confine the dead bodies to the inside of the lamp. Fix above the chimney a cone-shaped piece of bright tin, costing about 2d., not soldered, but kept together by "clipped" edges. The moths, attracted by the light, fly towards it, and, coming within the rays from the tin reflector, almost instantly fly up into the cone, and before they can reach the apex are scorched. If placed two or three nights in the blanket store-room, very few will be left to lay eggs and increase their kind. If cloths, blankets, etc., are tied up in calico bags, or wrapped in strong brown paper, very little damage can be done by the pests; however, where curtains, etc., are in use, the lamp plan must be followed, but the moths have, of course, done their destructive work by that time.

Mother-of-pearl (*see* Pearl)

Motor-car Lamps (*see* Acetylene)

Motoring Garments (*see* Cleaning)

Mounting

Mounting Maps (*see* Maps).

Mounting Paper on Canvas.—Stretch the canvas on a floor or table, driving in tacks round the four sides. Then paste the paper, lay it on the canvas, and rub well into contact. Allow the paper to become perfectly dry in this position; when taken up it

will be perfectly flat, and will not require pressing. Ordinary flour paste can be used; it need not be very thick, but must be smooth and free from lumps, and is best applied to the paper with a brush.

Mounting Parchment Certificate. — A parchment certificate can be treated exactly as paper, mounted on cardboard or lined with paper by using flour paste or glue. If the surface seems to be greasy, wash over with a weak solution of oxalic acid before pasting, and allow to dry. It is always better to use paste; put on a liberal supply and allow time for the paste to soften the parchment. When mounting on a board, paste the parchment, and when softened lay it evenly on the board. Rub down carefully, using paper between the rubber and parchment. If lining with paper, paste the paper and damp the parchment with water, using a sponge; lay the paper on the parchment and rub well down. When dry the parchment should be flat and free from wrinkles.

Mounts

Attaching Mounts to Pepper Boxes, etc. —To mount tops on pepper boxes, etc., the "Jeweller and Metalworker" advises the following:— Mix plaster-of-Paris with a little cold water to a thinnish consistency, and apply to the glass, and also to the inside of the mount, with a small spatula. When the top has been fixed, wipe round with a piece of rag to remove surplus plaster, or when set remove the surplus with a sharp knife. No other substance is used but the plaster-of-Paris for fixing tops to mounted glassware by some workmen. When it is wanted to set very quickly the plaster is mixed with warm water. The right sort of plaster for the purpose is the kind that smokes when the water touches it.

Removing Plaster-of-Paris from Mounts. —This is an awkward job, because the plaster is a very insoluble substance, being a kind of gypsum—lime sulphate, $CaSO_4$—and being soluble in cold water in the proportion of only about 1 oz. to the gallon of water. According to the "Jeweller and Metalworker," chlorine water will dissolve it, but that is objectionable, as it will also dissolve most metallic objects. The plaster is rather more soluble in water containing chloride of ammonia, or nitrate of potassium, than in ordinary hot water. The best way to remove plaster-of-Paris from mounted glassware when under repair is to place the article in cold water, and let it remain for a few hours; next take it out and work the mount about with the right hand, holding the article with the left hand till the top becomes loose, and then, when the mount has come off, remove the remaining plaster with a small knife or keen-edged tool.

Lamp Mounts (*see* Lamp)

Mouse Traps

The following is a very simple mouse trap, which is said to work well. Take a cylindrical piece of wood of $1\frac{1}{2}$ in. diameter —an old broom-handle will do admirably—and saw off a piece about 4 in. long. Shape

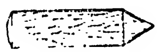


Fig. 477.—Bait Stick for Simple Mouse Trap.

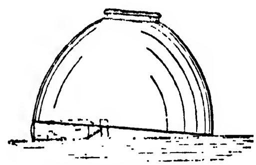


Fig. 478.—Simple Mouse Trap.

this as in Fig. 477, rounding off one end and pointing the other. This, with a large plate or dish, a basin, and a crust of bread is all that is needed. Thrust the pointed end of the stick into the crust and place it in the middle of the dish. Then place the inverted basin with one part of the edge resting on the plate and the opposite part resting on the rounded end of the stick, as in Fig. 478, and the trap is complete. Anyone can see how it works.

Self-acting Mouse Trap.—This little trap, which may be made in an hour, and at the outlay of a penny for material, works extremely well. The trap consists of a thin piece of wood, about 8 in. by 4 in., nicely balanced, and working on pivots in its edges, which are supported by side pieces fastened to a baseboard, that may be left square or shaped into a handle, as in Figs. 479 and 480. This is baited with a piece of toasted cheese or something similar, fastened loosely by a piece of thread, so as to swing free when the trap tilts; it must be placed upon the

edge of a table, or some similar object that will raise it a few feet from the floor and that is accessible to the vermin; and underneath a pail half filled with water should be stood. Then when the mouse runs nimbly on the plank, up it goes, and into the water he is precipitated, head first, when the plank goes gently back in readiness for another unsuspecting victim. Fig. 479 gives a side elevation of the trap, and shows how the side pieces are fixed and the bait is secured; and Fig. 480 is a plan, the full line showing the tilting board, and dotted lines showing the baseboard underneath; the two side pieces in which the pivots work are shown grained. Fig. 481 is a cross-section through the pivots, from which the thickness and widths of the various pieces can be obtained. Fig. 482 shows the trap in action, having just discharged its freight. This trap is so simple to make that it might be managed by a boy who possessed only a saw, a bradawl, and a penknife. Procure a piece of wood, 8¾ in. long by 3¾ in. wide, and 3/16 in. thick; the lid of a cigar-box or similar box may be adapted. The sizes specified are not absolute; anything about that size will do, so that the base piece is a trifle wider than the tilting piece, to allow the latter to move freely. Cut the ends of the piece square, and bevel them off as shown; this is to assist the mouse to leave easily, and it will be further improved in this direction if the top side is smoothed off with fine glass-paper. The base will require a piece about 7 in. long, 3⅞ in. wide, and ¼ in. thick; this may be shaped, as shown, with a fret-saw, and the edges then taken off by rubbing with No. 1½ glasspaper. Two side pieces, 2½ in. long by ½ in. wide and ¼ in. thick, with two ¾-in. fine French nails and a few shoemaker's rivets, will complete the materials. Commence with the tilting board. Having got that to size, shape the base piece, leaving the square part between A and B (Fig. 480) about 1/16 in. wider at each side than the top piece; then brad the two side pieces on the base, flush with the bottom side, letting the ends run over about ½ in., as shown at C C (Fig. 479). Now lay the top piece in the trough so formed, and mark its thickness on the side pieces X. A bradawl hole must now be bored in each of these pieces, so that its centre shall be in line with the edge of the base and the middle of thickness of the top board; the French

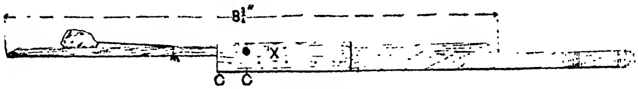


Fig. 479.

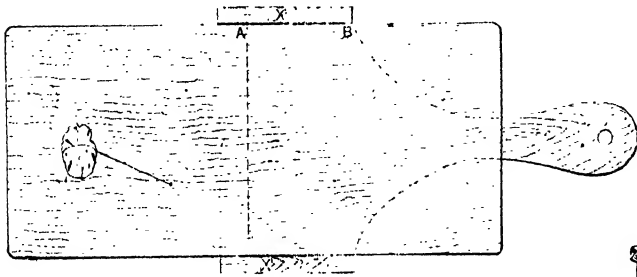


Fig. 480.

Figs. 479 and 480.—Side Elevation and Plan of Self-acting Mouse Trap.

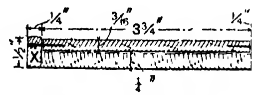


Fig. 481.—Cross Section through Pivots of Mouse Trap.

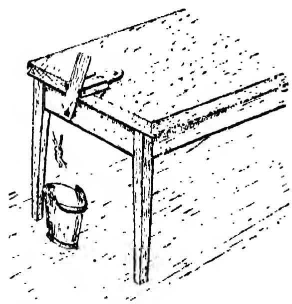


Fig. 482.—Self-acting Mouse Trap in Action.

nails should fit easily in these holes. Next put the board in place, keeping it slightly out of centre—that is, the larger half should be towards the handle; this is to counterbalance the bait. Then push the pivots in slightly, and try how the trap works; a slight touch with the finger should cause it to tilt, and it should return immediately to its original position. If satisfactory, take the pins out, and bore in a little way with the bradawl, so as not to split the piece; drive the pins home, first greasing them well, to prevent them rusting. When setting the trap, try a piece of bread or something to represent the mouse, and see if it falls in the centre of the pail, for, if the mice strike the edge in falling, they may jump out. For the same reason do not have too much water in—only just enough to drown them.

Muriatic Acid (*see* Acid)

Musical Instruments (Brass)

Removing Dents from Brass Musical Instruments.—There are many methods of removing the bruises from brass instruments, the position of the bruise determining the method to be employed. In some cases, to avoid taking the instrument to pieces, the top of a piece of stout brass wire is soldered to the indented spot, and the brass is then pulled up. This is, however, only practicable in the case of slight dents. Where the dent is in the smaller tubings or too far round the main bow to be accessible from the bell, the instrument must be taken to pieces at the joints and the bruises removed by one of a series of steel balls of graduated sizes, which is screwed on a curved and tapered steel arm fixed in a vice. The ball should fit the bore of the tube to be trued. This is then thrust over the arm, and the bruise pressed up from the inside by the steel ball. If the dents are sufficiently near to one end of the tube, a burnisher can be employed to remove them. The burnisher has the curve of its face equal to the curvature of the tube. The burnisher is merely placed in the tube and worked to and fro over the dent until it is smoothed out.

Mussel Shells

Polishing Mussel Shells.—First rub the shells with the finest emery powder, wet, on a piece of flannel, then polish with oxide of tin or putty powder, and finally with whiting, applied by the ball of the thumb without a cloth. To polish many shells a weak solution of hydrochloric acid has to be used to remove the rough "skin." The polishing then proceeds as above.

N

Nail Sets or Punches

THESE useful little tools are either round or square in cross section (*see* Figs. 483 and 484), and are employed for knocking nail heads below the surface of woodwork.

Nails

Twenty-one varieties of nails are illustrated by one of the full-page plates accompanying this book. The nails shown include practically all those with which the handyman is likely to desire an acquaintance, and the sizes in which they are obtainable are mentioned in every case.

Driving and Holding Powers of Nails.—The driving and holding powers of nails have been investigated by Prof. Carpenter, of Cornell, whose experiments seem to show that very much more force is required to drive a cut nail a given distance than a wire nail; that more force is required to start a cut nail than to drive it, and that it invariably starts much harder than a wire nail; that the work required to drive cut nails is much more than that to drive wire nails; and that the work in withdrawing cut nails is about equal to that in withdrawing wire nails, it being sometimes less and sometimes greater. The relative efficiency, which is here considered as the ratio of the work of pulling to that of driving, is much higher for the wire nail than for the cut nail. The cut nail bruised and broke the fibres of the wood, principally at the end of the nail, whereas the wire nail simply crowded them apart, and probably did not move them much beyond the point from which they would return by elastic force, and hence the nail would be grasped more strongly per unit of area of surface by the wood. Presenting less surface, there would be, however, less resistance to starting. To see what the effect of change of form would be, a number of tenpenny cut nails were sharpened on the point by grinding to an angle of about 30 degrees, so that the fibres in advance of the nail would be thrust aside and not bruised or broken. This increased the holding power of the nail, decreased the force necessary to start it, and increased the resistance to withdrawal.

Driving Nails in Walls.—A nail should never, for any purpose, be driven into the wall of a room. If the partition be

Fig. 483.—Round Nail Set.

Fig. 484.—Square Nail Set.

of lath and plaster, and the nail strikes a lath, it is apt to rebound because of the elasticity of the lath, and a breaking away of the plaster is generally the result; while if the nail be driven into the plaster between two laths, it will not hold. If the partition is really a wall (constructed of stone or brick), a nail cannot be satisfactorily driven into it without first drilling a hole and plugging it. (*See also* Plugging Walls.)

Sizes of Nails.—Nails are distinguished as to size by the now meaningless terms, "sixpenny," "eightpenny," "tenpenny," etc. Formerly, nails of which 1,000 weighed

6 lb., would be called "6 lb." Similarly, when 1,000 weighed 8 lb., the nails would be called "8 lb.," and so on. "Penny" is a mere corruption of "pound," and therefore "sixpenny" nails are those of which 1,000 weigh 6 lb., and "tenpenny" nails those of which 1,000 weigh 10 lb.

Name-plates

Filling Name-plates.—The old method is to fill the letters with best sealing wax, either black or red, ground up in an iron mortar. The best wax should be obtained, and, failing the use of a mortar, the wax may be broken into convenient pieces, placed between two clean pieces of brass or iron plate, and the whole wrapped in several thicknesses of brown paper; the package is tied up with twine, and hammered well. This will break up the wax small enough. Have the plate quite clean, and fill all the cuts with the powdered wax, taking care not to let it get all over the plate; with a camel-hair brush gather the wax in a little hillock above the surface of each cut to allow for sinking. Put the plate into a hot oven and watch it carefully, turning the plate frequently so as to heat it evenly all over. Do not let the wax bubble or boil, or it will contain air-holes. If the use of an oven is not convenient, stand the plate upon two bricks, and burn paper under it until the wax melts. Probably, also, the top of a modern gas cooking-stove would answer the purpose admirably. As soon as the wax begins to melt, take out the plate from the oven, and press the wax into the cuts with a flat piece of metal. Any wax that may be smeared over the plate can be wiped off while the metal is hot, if it is not too close to the letters. The plate must now be left to cool gradually. To remove the superfluous wax from the surface of the plate, a water-of-Ayr stone must be freely used with plenty of water. Rub the stone always in the same direction, lengthwise being preferable. The utmost cleanliness must be observed, as any foreign matter rises to the surface, and the wax should be rubbed down till a clean and brilliant colour results. The surplus being removed, dress the plate with a piece of leather and crocus powder moistened with common oil. A final polish with a piece of soft chamois leather may be given; if the filling is black, use lampblack as a polishing medium with the leather; the finest rouge will answer in case of a red filling; or the brass plate may be polished with metal-polishing paste. Another method of filling is to use the black or red powdered wax ground up with gold-size or mastic varnish; the letters are filled with this composition by means of a palette knife, and left to set quite hard and bright. The surface is cleaned with a little alcohol and a pointed rubber, a little being done at a time, drying off with a clean cloth, and finishing with metal-polishing paste. A third method of filling letters is to use sealing wax dissolved in alcohol to make a thick paste. When the alcohol is evaporated, the mixture will harden, and then the plate can be finished as usual.

Naphtha

Naphtha is a generic name; for instance, there is coal-tar naphtha, mineral naphtha, and wood naphtha, all distinct products (*see also* Benzene and Benzine). Coal-tar naphtha and benzene are obtained by the distillation of coal-tar; mineral naphtha is obtained in the distillation of crude petroleum—it is the fraction which passes over before the paraffin oil or kerosene; wood naphtha is a product obtained in the distillation of wood, and consists principally of methyl alcohol and acetone. Solvent naphtha is the coal-tar distillate, and is used in dissolving indiarubber, for which purpose wood naphtha is useless. Benzene, or benzol, is essentially the same as solvent naphtha.

Deodorised Naphtha and Benzoline.—Deodorised naphtha and benzoline are used for purposes in which the odour of the common liquids would be objectionable—for instance, in cleaning clothes and for the extraction of oils from crushed oil seeds. In cleaning clothes by the dry process, after treatment with benzoline there is a strong smell left on the clothes, hence the use of a rectified benzoline called "camphene." The treatment of oil seeds for extraction of oil is much more thoroughly done by solvents than by pressure, but hitherto

the process has not come into use because the strong-smelling matter from the solvent remained with the oil and rendered it unfit for most purposes; with a deodorised naphtha there is not this objection. Deodorised naphtha may also be used for removing grease, smut, dirt, etc., from sheep's wool, instead of washing; this operation is carried out in closed chambers, the naphtha being afterwards recovered from the grease and used again.

Naphthalene

Naphthalene or "albo-carbon" is a white crystalline substance with the odour of tar. It is a product of coal-tar, but differs from benzene, and is used to preserve clothes from moth, as a disinfectant, and in the "albo-carbon" gas lamp. It is not a true disinfectant; it merely disguises smells by the strength of its own. Naphthalene may be carefully melted at a low heat in an ordinary melting-pot, and ladled

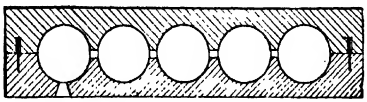


Fig. 485.—Mould for Casting Naphthalene Tablets.

into the moulds with an iron ladle. Great care must be taken, as if submitted to a high temperature the naphthalene will burn. It may be cast either in iron or wood moulds, and these should be made in two halves, which are connected together with pins; in each half should be sunk a number of hemispherical depressions in a line with a tube connecting them all together. At one end should be drilled a ½-in. hole for pouring in the melted naphthalene. Fig. 485 shows a suitable mould. The balls may be separated by breaking off the attached pipe. (*See also* Deodorising Tablets.)

Nickel

Nickel is a white, malleable, ductile, and tenacious metal capable of receiving a silver polish. It resembles iron in some respects, being magnetic, weldable, and being influenced by the presence of carbon, which lowers its melting point; this, in pure nickel, is but little below that of iron. Nickel is not readily oxidised by an ordinary atmosphere, but oxidation takes place when the metal is heated. It is but little affected by most acids, but is easily dissolved by nitric acid. Cast nickel has a specific gravity of 8·357, whilst that of rolled nickel is 8·729. Nickel has its most useful application in the formation of alloys, the chief of these being German silver or nickel silver. Another important use is as a rustless coating for steel and other metals. There is a number of nickel ores.

Blackening Nickel Chemically.—(1) Dip the parts till bright in aquafortis, rinse off the acid in several changes of clean water, and place in a solution made up of ¾ pt. of hydrochloric acid, 1 oz. of sulphate of iron, and 1 oz. of pure white arsenic. Allow the articles to stand till sufficiently black, then take them out, well rinse and dry them in clean sawdust, and afterwards coat them with pale lacquer. (2) Or the articles may be blackened by placing for a sufficiently long time in sulphuretted hydrogen gas. (3) Another method is to plate the articles lightly with silver, then immerse them in a solution formed by dissolving 2 dwts. of sulphate of copper, 1 dwt. nitrate of potash, and 2 dwts. of muriate of ammonia in a little acetic acid. The articles must first be warmed, and when immersed should be immediately placed in a closed box and exposed to sulphur fumes. This will oxidise the silver and produce a deep black.

Black Nickelling Process.—The black nickelling process is similar to the ordinary white nickel-plating process except that the solution used is different. The black deposit produced will stand buffing in the same manner as ordinary nickel-plating. The deposit is equally tenacious, and the cost is practically no more. The bath for the deposit of black nickel is made up as follows. Dissolve 12 oz. of the double salt of nickel and ammonium sulphate in 1 gal. of water; add 3 oz. of sulphocyanide of potash, and afterwards 2 oz. of carbonate of copper. As 2 oz. of white arsenic is to be added, some means will have to be adopted to get it into solution. Place the arsenic in a small jar, add some carbonate of ammonia

(just sufficient to dissolve the arsenic) and water, and heat gently for a time, but do not boil; the solution should be about lukewarm, and continually stirred till dissolved. If the arsenic does not go into solution, add a little more carbonate of ammonia and a little water if necessary. Several additions may be required before complete solution is obtained. Now add the liquid to the previous bath and well stir. Care must be exercised in the use of this bath, as frequently very bad results are caused by slovenly use. In using the bath, the arsenic apparently does not consume, so that any addition will not be required for a long time. Should the deposit become of a greyish colour, a little more sulphocyanide of potash and carbonate of copper must be added. Add a little at a time, and in no case overdo it. After a time, the bath will need revivifying with an addition of the nickel salts and solution of arsenic. The strength of the mixed solution to give the best result should be about $6\frac{1}{2}°$ hydrometer. The articles to be plated must be thoroughly cleansed from grease, oil, and dirt, and all parts should be dipped in the potash or lye bath, then well swilled, afterwards dipped in the cyanide solution, and then in the black bath. The same rules apply to the deposit of black nickel as to white nickelling. The plater will use his discretion as to the strength of the deposit, some probably requiring more deposit than others. Small work may be plated in baskets, larger work by wiring. When the required deposit has been obtained, rinse in cold water, and dry in hot sawdust. The intensity of the black will be governed by the arsenical solution, and will range from a deep velvety black to a paler shade. If too weak in arsenic, the deposit will peel off. Ordinary nickel anodes, as used for white plating, are employed. They must be cleaned down about once a month to ensure right working.

Nickelling Pastes.—Pastes and solutions that are said to be substitutes for electro-deposited nickel are being made and sold. The makers claim that a bicycle can be coated with pure nickel by an application of the paste or solution. The composition of these is secret, but their effects on cycles are too well known to create a desire for their use. A bicycle that had been previously coated with one of these pastes was examined; every part of it was so deeply corroded with the action of the nickelling paste as to render a smooth surface impossible by any amount of grinding and polishing. These effects are just what might be expected, since all such pastes and solutions must deposit their metal by chemical action on the metals to be coated by them, and this means that they dissolve and corrode the metals. Pastes containing mercury are sometimes fraudulently sold for nickelling and silvering pastes. When rubbed on surfaces of brass, copper, and German silver, the mercury adheres to these metals and leaves a bright white polish resembling nickel, but this soon loses its lustre and needs renewing. The following is a nickelling composition for use on clean copper or brass: Nickel chloride, 1 oz.; precipitated chalk, $\frac{1}{2}$ oz.; finely divided zinc, $\frac{1}{2}$ oz.; ammonium carbonate, $\frac{1}{2}$ oz.; make into a paste with dilute liquor ammoniæ. It may be tried, but will probably not give satisfaction. Nickelling pastes do not give satisfactory results unless a salt of mercury is mixed with them, and then the deposit is one of mercury instead of nickel. The salt of nickel employed must be crushed to a fine powder, and the zinc must be in the form of fine filings. The nickel salt may be previously dissolved in boiling water to saturation, then mixed with the other ingredients to form a paste, adding the ammonia whilst using the paste. The paste must be well rubbed on a thoroughly cleaned copper or brass surface to secure a deposit of nickel. The following may be also tried: Equal parts in bulk of double sulphate of nickel and ammonium, whiting, and common salt, add $\frac{1}{2}$ part of clean zinc filings, and make into a thin paste with dilute liquor ammoniæ. These pastes give results of no value, because the deposit is very thin.

Nickel-plating by Non-electrical Process.—A non-electrical process of nickel-plating is known as the Mitressey process, introduced in France. Instructions given are as follows: Clean the objects in 5 kilogrammes of American potash per 25 litres

of water. (For rusted pieces use 2 litres of chlorhydric acid per 1 litre of water.) Now put 250 grammes of sulphate of copper in 25 litres of water; after the sulphate is dissolved, add a few drops of sulphuric acid, drop by drop, stirring the liquid with a wooden stick until it becomes as clear as spring water. Immerse the pieces in this, attaching them to leaves of zinc. When they have assumed a red tint, pass them into the nickelling bath, which is composed of cream of tartar, 20 grammes; sal-ammoniac in powder, 10 grammes; kitchen salt, 5 grammes; oxychlorhydrate of tin, 20 grammes; sulphate of nickel, single, 30 grammes; sulphate of nickel, double, 50 grammes. Remove the pieces from the bath for a few minutes, and rub them with fine sand on a moist rag. This is to get a brilliant deposit. To improve the appearance, rub with a brass wire brush, and if convenient finish off on a piece of buff glued on a wooden wheel, and smeared with red stuff. The above process might be employed to deposit nickel on metal not subject to wear and tear, such as ornamental pieces that may be lacquered immediately to preserve them from tarnish. But the process is useless for nickel-plating articles in daily wear, as the deposit of nickel can be only loosely adherent to the metal on which it is deposited, since it adheres by the action of chemical displacement, as in simple silvering processes. To copper iron and steel by this process some of the iron is dissolved by the sulphuric acid in the copper sulphate solution, and copper takes its place. The deposit of copper is therefore loose, and this forms the foundation of the nickel deposit. Nickel is deposited on this loose foundation by chemical substitution, some of the copper being dissolved and nickel taking its place, together with some tin, since this also is present in the nickelling bath. All such processes should be tested on a small scale at first, in a most thorough manner, for a long time, before putting the coated articles on the market.

Oxidising Nickel (*see* Oxidising).

Restoring Tarnished Nickel.—To restore the colour of tarnished nickel or similar metals, plunge into a solution of 0·4 to 0·45 gramme of cyanide of potassium in half a glass of water, and withdraw them immediately. Rinse in water to remove acid. and then plunge in spirit of wine, and dry in sawdust. If the tarnished metal is greasy, it must first be cleaned with benzine before being treated. The cyanide is poisonous, and should be handled with care in a well-aired room.

Rusty Nickelled Surfaces.—To remove rust from nickelled objects, smear the rusted surface with grease, and after a few days rub with a rag soaked in ammonia. If some spots resist, pour on a little dilute chlorhydric acid; wipe off immediately, wash with water, and when the surface is dried apply rottenstone.

Night-lights

Paraffin wax will readily melt and run, if shaped, into the form of a night-light; composite material is best. For making night-lights on a small scale a turned and polished iron mould will be required, consisting of a ring of iron, slightly taper inside, provided with an iron plug, which fits tightly at the small end. In the centre of this iron ring is an ordinary candle wick, which should be held upright. The candle material, melted, strained, and somewhat cooled, may be poured into the mould, and, when set, the wick may be cut, and the plug forced up.

Nitric Acid (*see* Acid)

Nutmegs

Artificial nutmegs, made in Belgium, are distinguished by their appearance from natural ones only with difficulty. Chemical analysis shows them to consist of a mixture of finely powdered nutmeg (from extracted or injured kernels) and about 20 per cent. of mineral substances. To detect artificial among natural nutmegs, one of three methods may be employed. (1) Cut them open; in the artificial article the well-known plant-like structure of the real nutmeg is absent. (2) Immerse for three minutes in boiling water; artificial ones are then soft. (3) Burn them; a true nutmeg leaves but 2 or 3 per cent. of ash, the artificial one about 18 per cent.

O

Oak

"Ageing" Oak.—After seeing that the oak article is perfectly clean, and free from glue, varnish, polish, or other marks, sponge it over with strong coffee; rub this well in, and wipe off with a clean rag that has just been wrung out in hot water. A slightly darker tone can be obtained by brushing or sponging the oak with a solution consisting of one pennyworth of carbonate of soda dissolved in 1 pt. of boiling water. A still darker tone can be gained by using washing soda instead of pure carbonate of soda. Wiping over with water strongly impregnated with lime will give also a nice tint. Experiment on odd pieces of wood before starting on the article. The secret of success lies in a clean surface and in using the solution weak rather than strong, gaining the desired result by two or three applications instead of one. By sponging off with hot water the stained or "doctored-up" appearance is avoided.

Oil (*see also* Lubricant)

Cleaning Oil Drums.—Place in each of the drums ½ lb. of caustic soda, and fill up with cold water. Set them over a suitable fire and boil until the oil leaves the sides and bottom of the drums. Obtain a piece of iron or steel about 3 ft. long, 1 in. wide, and ¼ in. thick, sharpened at one end similar to a wood chisel; with this continually scrape the sides and bottom of the drum until all the loose oil and skin are removed. The drums should next be emptied and well rinsed with cold water to remove all traces of the soda, and then placed upside down to drain, after which they are ready for use. To reduce the cost somewhat, the soda solution may be repeatedly used until it becomes too thick or dirty with the oil. Steam may be employed instead of boiling over the fire; this method is adopted by oil manufacturers and others on an extensive scale.

Oil Cement (*see* Cement).

Oil, Engine (*see* Engine Oil).

Oil Filters.—A simple oil filter may be made from two clean meat tins placed one above the other; in the upper tin, with a bradaw, punch a number of small holes, and over these spread a piece of flannel. A filter may be made from two tinplate vessels like a pan and steamer, the upper one fitting in a rim in the lower one, while a piece of flannel placed between the two vessels will serve to filter the oil. It may not clarify the oil perfectly at first, but will soon get into working order. A waste oil filter either can be an expensive article, or can be made from two empty tins as in Fig. 486. Make a 4½-in. hole in the top of one as at A; solder a small cock B, or a piece of ½-in. brass tube fitted with a proper plug 1½ in. from bottom. Solder a tin hoop C round the top to receive the other tin. This latter must have its bottom D perforated; do this with a stout darning needle broken in half and passed through a cork; make about sixty holes to the square inch. Cut out the top and perforate it also; then stand one tin on top of the other as shown in Fig. 486. Place in the top one a 2-in. layer of pine sawdust

from which the finest has been sifted out; on top of this place the perforated piece E to keep the sawdust from stirring up when the oil is being poured in. Pour in the waste oil and fit the top can with a cover F to keep out dust, etc. On the following day almost all the oil can be drawn off in a condition fit for use. When this filter gets foul, lift out the perforated cover, scrape off $\frac{1}{4}$ in. of the sawdust, and it is again fit for use.

Oil Gilding (*see* Gilding).

Oil, Harness (*see* Harness Oil).

Oil Lamps (*see* Lamps).

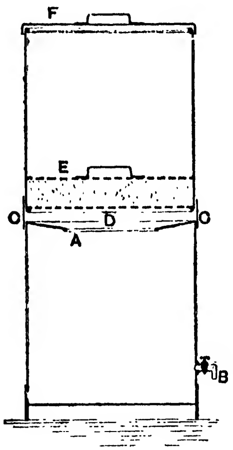


Fig. 486.—Oil Filter.

Oil Paintings (*see* Picture).

Oil, Paraffin (*see* Paraffin).

Oil Stoves: Blue-flame.—Fig. 487 gives a general idea of the Primus (blue-flame, wickless) oil stove, the burner of which, for cleaning purposes, may be said to consist of two parts, namely, the tubular burner, and the nipple in the burner from which the vaporised oil issues. The nipple may be blocked with particles of carbonised material, and this can be cleared with the cleaning-pin sent with the stove or with a fine needle point. If the point of the cleaning-pin becomes broken in, the nipple must be removed and either the pin got out or a new nipple put in. A new nipple is necessary if the hole in the old one has become too large. With stoves Nos. 0 and 1, or any burners not open at the top, a special spanner, with universal joint, is necessary. In fact, if there is much work in repairing these stoves the local tradesman should get a set of the several special tools requisite. The wholesale houses keep them, and they are very cheap. The burner itself is considered to do 1,000 hours' burning with good oil, but if the oil is common the burner will get clogged up sooner. It will be understood that as the oil, while in the burner, is subjected to a fierce heat, a certain amount of carbonisation occurs, and clogging must ensue sooner or later. To ascertain whether the burner is clogged, empty the oil out of the tank, remove the nipple, stop the nipple hole with a plug, pump the tank full of air, remove the plug from the nipple hole, and if the air rushes out swiftly, then the burner is clear and the nipple must be at fault. If the air does not rush out freely, then the burner is at fault. The only remedy for a clogged burner is to replace it with a new one. The burners are cheap, and easily fitted with an ordinary spanner. When fitting a new burner, first soak the asbestos washer in water, so that, when the burner is screwed on, it will make a perfectly sound joint.

Oil Stove Wick becoming Hard.—When this happens, the wick fits too tightly. It may fit easily enough and burn well when first put in, but when it becomes thoroughly saturated with the oil it swells and is hard to turn up; the flow of oil to the top is diminished by the wick being squeezed into a space too small for it, and thus the lamp burns badly. Put in a piece of a cheaper and thinner kind of wick, taking care that the wick, before putting it into the oil, is clean, free from grease, and thoroughly dry. All lamp wicks should fit very easily when dry, in order to allow for the swelling when wet.

Oilcloth (*see* Floor Coverings)

Oilskins

Preparing Oilskins.—(1) The materials are first made up into coats, trousers, and the like from a strong twilled cotton. After shrinking with cold water, the garments are laid out on a table and given a coat of oil applied sparingly with a brush; they

are then hung up to dry. In fine weather they are dried in the open on lines, but in wet weather they should be dried in a covered shed. When the first coat is quite dry another coat is applied, and the gar-

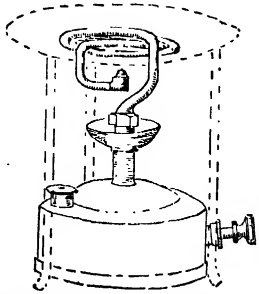


Fig. 487.—Blue-flame Oil Stove.

ments are again thoroughly dried. To protect good oilskins at least three or four coats must be applied. The best boiled linseed oil is used, but sometimes a small quantity of gold-size or drier is added; this should not exceed 1 oz. or 2 oz. to the pint of oil, as too much renders the film brittle. The drier causes the oil to dry more quickly and more thoroughly. If the oil is applied as thinly as possible at each coat it will not become sticky, but should any tackiness remain, hang out the oilskins in the sun again. A little French chalk rubbed on will prevent any sticking. (2) The following is said to be a reliable method of preparing oilskin garments:—The articles having been made of suitable pattern and material, procure a sufficient quantity of the best raw linseed oil, and, with a pad of flannel, go carefully over them, rubbing the oil well into the material, but using as little oil as possible. They must then be hung up to dry in a dry, cool place where they can have a good current of air, protected from the sunshine. This process will take from two to three weeks to accomplish. When thoroughly dry, the process of oiling and drying must be gone through twice more, making three coats in all. Boiled oil, which will take less time to dry, may be used; but he raw oil will be found more satisfactory, as it is less likely to go sticky. By mixing a little powdered blacklead with the raw oil all chance of stickiness will be obviated. When the garments are hung up to dry, care should be taken to distend the arms and legs clear of one another, so that the air may circulate inside as well as outside. The addition of the blacklead will, of course, affect the colour somewhat, if it is not intended to paint the articles black; but this objection will be more than counterbalanced by the increased comfort. Old oilskins that have gone leaky or sticky should be thoroughly cleaned before re-oiling; this may be done by soaking them for twenty-four hours in a strong solution of common washing soda and soft soap, afterwards laying them out flat on a board and giving them a good scrubbing with a medium-strength scrubbing brush; finally rinse them in fresh water till thoroughly clean and hanging out till perfectly dry. At this time any little repairs may be executed.

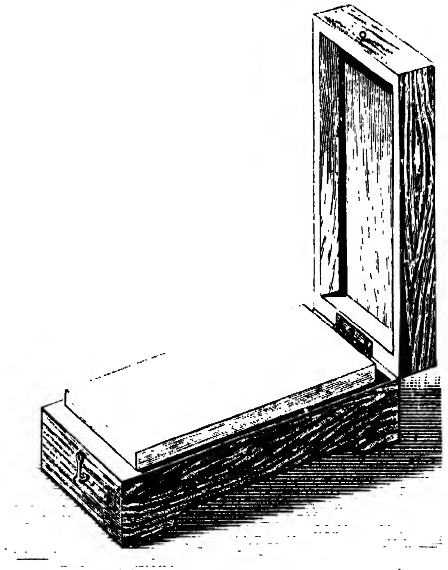


Fig. 488.—Oilstone in Case.

Oilstones

Oilstones are used for imparting a keen edge to tools. Those in most general use are four in number—the Charnley Forest, Turkey, Washita and Arkansas. The

Charnley Forest is an old-fashioned English variety, which is very durable. It is a slow cutter, producing a fine edge, but the pores get clogged with oil and the stone becomes very hard. Turkey stone is very close-grained, giving a fine keen edge to tools, but wearing unevenly. It is also very brittle. The cheapest oilstone is the Nova Scotia or Canada stone; it varies considerably in quality, and wears away rather quickly. The Washita stone, though it wears away quickly, does so more regularly than the Turkey stone. It is very even in texture, and is a fast cutter, but does not produce an edge fine enough for best work. Arkansas oilstone is a compact white stone, something like Washita, but finer in grain; it wears well and cuts slowly. It is considered to be the best oilstone in the market, but it is very expensive. The most convenient width for an oilstone is 1½ in., with a length of 8 in. An oilstone is preferably protected by a proper case (*see* Fig. 488) from dust and dirt, which readily adhere to the oily surface. Oilstone slips in a great variety of shapes are available for sharpening gouges and special tools, for which a flat stone cannot be used.

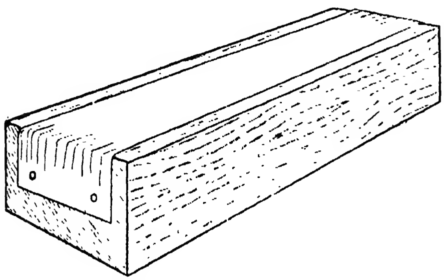


Fig. 489.—Zinc and Emery "Oilstone."

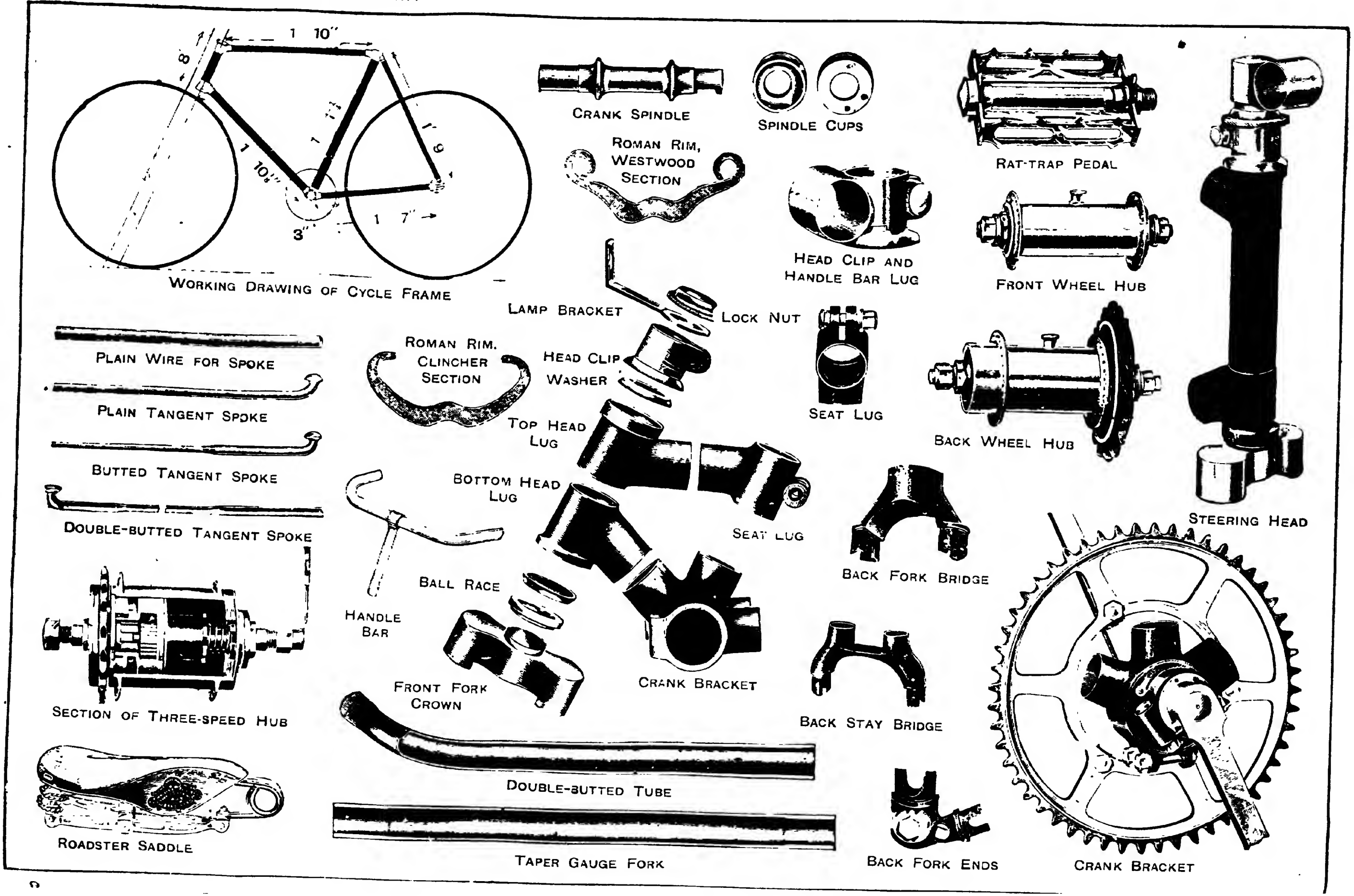
Artificial Oilstones.—Three kinds of artificial oilstones are now made. First, there are plain emery slips or blocks; secondly, Indian oilstones, made from Indian corundum; and thirdly, the carborundum oilstones. All of these are so hard that they cannot be ground or trued up on a grindstone. They may be trued, however, by using emery, corundum, or carborundum upon an iron plate or lap. The ordinary oils are used on the artificial stones, some of which, however, will cut as well with water as with oil, providing plenty of water is used.

Cleaning Oilstone.—Boiling is the best remedy for a thoroughly dirty stone. Soaking in petrol, benzine, or benzene is another remedy.

Cutting Oilstone into Slips.—Get an old saw of any description, file off the teeth, and with it make the cuts required, using silver sand or emery powder and water in the kerf to assist the cutting.

Levelling Oilstones.—Levelling an oilstone is generally done with coarse emery on a board or upon the side of a grindstone. A recently proposed method of quickly reducing parts of a stone which stand too high or improving the form of a worn slip is to scrape it with the edge of a piece of glass, used in the same way as a steel scraper is used on wood. The stone can be scraped in this way either with or without water. Without water is perhaps preferable, as it is then easier to see how much is being removed. If one end or one corner of the stone stands higher than the rest, it is easier to reduce to a general level in this way than by the ordinary methods, which make the surface flat, but cannot easily remove a slope to one end or one side. A slight inclination in any direction causes the oil to run off the stone, and it is advisable, therefore, always to leave the stone slightly hollow, so that the oil will tend to run to the middle when it is left standing. The greatest wear occurs not in the middle of a stone, but near the ends, at the places where the movement of the tool is reversed. It is, therefore, chiefly a small area at the extreme ends which requires scraping down, and sometimes a little in the middle and along the sides, to remove some of the hollowness. When the stone is reduced in depth, the edges of the case and cover may be scraped, and a few shavings planed off; the stone and case may thus in a few minutes be made as clean as when they were new.

Lubricants for Oilstones.—These include neat's-foot, sperm, lard oil mixed with paraffin, sweet oil or vaseline mixed with paraffin, and other mixtures of animal and mineral oils. Vegetable oils obtained from


1 10″
8″
1 11
1
1 10½″
1′ 9
3″
1 7″
Working Drawing of Cycle Frame
Crank Spindle
Spindle Cups
Rat-trap Pedal
Roman Rim, Westwood Section
Head Clip and Handle Bar Lug
Front Wheel Hub
Lamp Bracket
Lock Nut
Seat Lug
Plain Wire for Spoke
Roman Rim. Clincher Section
Head Clip Washer
Back Wheel Hub
Plain Tangent Spoke
Top Head Lug
Butted Tangent Spoke
Bottom Head Lug
Seat Lug
Steering Head
Double-butted Tangent Spoke
Back Fork Bridge
Ball Race
Handle Bar
Section of Three-speed Hub
Front Fork Crown
Crank Bracket
Back Stay Bridge
Double-butted Tube
Roadster Saddle
Taper Gauge Fork
Back Fork Ends
Crank Bracket

seed and nuts are not suitable. Soap lather has been recommended. A lubricant for oilstones recently recommended is glycerine thinned with a very little alcohol. Where the hard Arkansas stones are used a mixture of good machine oil and benzine is suggested.

Quick-cutting Oilstone.—To put an edge on a chisel or a plane iron on the common type of stone is a work of time and patience, and to get rid of a small gap generally means the use of the grindstone. The quick-cutting "stone" shown in Fig. 489 can be made by anyone at a very small expenditure of time and money. Take a block of wood about the size of the wooden case of an oilstone. Nail to one end of the block a strip of ordinary roofing zinc about 2 in. or 2½ in. wide. Bend the zinc over the face of the block, as shown, tighten, and nail down at the other end. It should be used as an ordinary oilstone, placing oil and emery powder on the zinc. This reduces to a minimum the trouble of sharpening tools. The edge obtained is quite fine enough for soft woods; for the harder kinds, it is advisable to finish off on an ordinary oilstone.

Self-oiling Oilstone.—A self-oiling oilstone, known as the "Oilshere," is sold by a firm in Ohio. A sheet-steel box has in one end an oil reservoir which is so arranged that by pressing the thumb upon a spring brass top the oil is sprayed out upon the stone, which is contained in the box or case of which the oiler forms a part. The construction of this case protects the stone from damage and dirt, and saves frequent annoyance and delay, occasioned by oilers being lent, lost, or otherwise separated from the stone. The box is provided with a slide cover, which will not drop off if a tool chest turns over. Carborundum sharpening stones are also on sale fitted with this device.

Oleographs (*see* Picture)

Onyx

Polishing Onyx.—The onyx must first be cut in order to form a level surface for polishing. The cutting is done with a lapidary's wheel, which is made of sheet iron and fitted to a vertical spindle driven by a treadle and flywheel in the same way as a foot-lathe, except that the wheel revolves horizontally. A lathe would serve the purpose, but if it were used the cutting wheel would, of course, revolve vertically. The wheel is bevelled on the edge, and is kept supplied with emery and water, while the stone is forced against it. When a flat surface has been obtained by cutting, it is held against the flat side of a copper wheel, flour emery and water being used, until the surface is quite smooth. It is then held against a wood wheel, sand and water being used; next against a pewter or copper wheel, using rottenstone and water; then against a wood wheel covered with leather, with a little putty-powder or rouge slightly moistened. It should be kept on the last wheel until a fine polish is obtained. The wheels mentioned are all of the same size, about 8 in. or 9 in. in diameter for small stones. The iron wheel will be about $\frac{1}{16}$ in. or $\frac{1}{32}$ in. thick, and should run perfectly true; to prevent it buckling, two thick iron washers, about 3 in. in diameter, should be used, one on each side of the plate. The copper or pewter wheel is about ¼ in. thick, and the wood wheels 1 in. thick. The upper part of the spindle has a thread, about 3 in. long, cut upon it; a nut is put on first and screwed up tight, then one of the washers, followed by the iron plate and another washer; lastly, a second nut is put on and screwed up tight, and the machine is then ready for cutting. When the other wheels are to be used, they may be laid upon the iron wheel and the larger washer left off, the nut being screwed down upon an ordinary small washer.

Opal Letters

Opal and enamelled letters may be fixed with equal parts of dry and wet white-lead made into a paste with japanners' gold-size or varnish. The wet lead by itself may answer.

Optical Matters

Binoculars.—The advantage of a binocular telescope or field glass is that it enables both eyes to be used, thus avoiding the inconvenient closing of one eye, as well as giving a better appreciation of relief and

the relative distances of various objects from each other, which cannot be so well perceived with one eye only. A prismatic binocular is a binocular fitted with glasses of prism form instead of the ordinary spherical lenses, thus securing great brilliancy and clearness of definition in the image and a larger field of view, considering the small compass of the instrument, which thus has the valuable merit of compactness and portability.

Bronzing or Oxidising Binocular Tubes, etc.—The dead black oxidising (or, as it is called in the trade, the bronzing) used on binocular tubes, etc., is made and applied as follows: Pour into an earthenware pot ¼ lb. of nitric acid, and stand it in an open place so that the fumes may easily get away. Now put ¼ oz. of copper wire into the pot and let the acid eat it all away. When it has stopped boiling add 1¼ oz. of water. This is now ready for use, and will be strong enough to bronze all the parts of an ordinary binocular. Increase the various ingredients proportionately for larger quantities. To do the bronzing, heat each piece separately over a Bunsen burner, and immerse it in the nitric bath; when immersed it should just hiss. Take it out, draining back as much of the acid as possible, and burn off all the green till it goes quite black all over. When cold, get a brush and a little powdered blacklead and brush off all the corrosive. When this is done it will be seen that the metal has turned to a beautiful black, with a fine granulated surface.

Cementing Lenses of Object Glass.—Obtain some pure Canada balsam, which should be of about the consistency of honey, at the chemist's. Put it in a saucer in the oven, and bake until, when cold, it becomes a hard mass. This is broken up, placed in a wide-mouthed stoppered bottle, covered with benzene, and allowed to stand till the next day, when it is gently heated over a water bath until fluid. The stopper should, of course, be removed while heating. Next very carefully clean the two lenses with a soft silk handkerchief, seeing that there is no dust on them. Warm the glasses before a fire, pour a drop of the warm balsam into the centre of the concave glass, and gently press down the convex one upon it, until the balsam is seen to spread all over and to ooze out at the edges. Now place the cemented lenses in a slightly heated oven, with the door open, until the balsam has hardened to some extent, when they may be taken out and allowed to stand for a few days to harden thoroughly. Any surplus balsam may be cleaned from the edges of the lens by means of a little benzene applied with a soft rag. Benzene should be used with care, and kept away from any light or flame, on account of its extreme inflammability.

Dead Black Varnish for Optical Work.—Tubes for optical work may be given a dead black finish by applying a black varnish made with turpentine, so as to dry without gloss, or by depositing a metal, in a finely divided condition, from a solution of some metallic salt on the tubes by a chemical process. A good varnish may be made as follows: Take a teaspoonful of fine lampblack, vegetable black, or drop black, place on a marble slab, or on a smooth slate, and form it into a stiff black putty by the addition of gold size, drop by drop, mixing all together with a palette-knife. Grind this on the slab with turpentine, and thin with this medium until the required thinness has been obtained; then apply with a camel-hair brush. Vegetable black ground with thin French polish has been used, and also a varnish made with ivory black ground in thin shellac varnish, then applied to the warmed tubes. A dilute solution of platinum chloride in water will dry densely black on zinc and brass, and probably on aluminium also; 1 oz. of silver nitrate and of copper nitrate dissolved in 1 pt. of water, then mixed together, will deposit a black coat on warm, clean brass-work. For blackening the brass frames of opera glasses, a black stoving enamel is generally employed. These enamels, which are made especially for the purpose, are, as a rule, composed of linseed oil, copal, or other resin, asphaltum, and turpentine. They dry quickly, and will withstand a moderately high temperature without any deterioration. The articles to be blacked are first made smooth and perfectly clean, a coat of the varnish is applied, and, after it is dry, the articles are hung for several hours in a stove

kept at a temperature of about 300° F. This treatment is repeated perhaps two or three times until a perfectly smooth, level, and brilliant black coating is obtained.

Double Image in Field Glasses.—Two or three causes may produce this fault. The two telescopes which form the field glass may not be exactly alike, and their lenses may not be similar; or the fault may lie in the eyes of the observer. It is evident, however, that the two telescopes are forming separate images. The remedy is to discover by experiment to which telescope the fault is attributable, and then to substitute correct lenses in one or both telescopes.

Focal Length of Lens.—The focal length of a lens may be determined with sufficient accuracy for all ordinary purposes by pointing the camera at the sun and focussing the image as sharply as possible, with the largest opening of the lens. Now measure the distance between the diaphragm slot and the ground surface of the focussing screen; this will be the required focal length. Another method is to fix a foot rule to an upright wall, and move the camera backwards and forwards until the image of the rule is exactly 3 in. long, and is in sharp focus. Measure the distance between the rule and the focussing screen, multiply this sum by 4, and divide the product by 25; the quotient gives the focal length.

Polishing Mounts of Field Glass.—The only method of repolishing the brass mounts of a field glass without injuring the casing of the telescope is to take the instrument to pieces and treat each piece separately. First remove the lenses, which will unscrew readily. Then take out the screw of the focussing arrangement. This will enable the top bar to be removed. But it will probably be more difficult, if not impossible, to remove the two strips which connect the body tubes of the two telescopes and retain the focussing arrangement in position. If the tubes are burnished into the strips, then their separation will be impracticable. By a steady pressure exerted on both bars immediately over each end of the focussing arrangement, it may be possible to remove that from its place, as it is held in position only by the pressure of the bars. Then the strips or bars must be carefully cleaned with fine emery paper. After the old lacquer has been removed, these bars must be polished with blue-black emery paper and lacquered with a cold lacquer. The other parts may be cleaned in strong soda water. Remove the lenses from their cells, marking their exact positions in relation to their cells and to each other, so that no mistake is made on re-insertion. Place the pieces in a pot containing the soda water, and boil them all for a little while. Wipe them dry, and polish and lacquer in the usual way. The circular pieces must be papered and lacquered on a lathe, the flat eye-piece bar being straight-grained.

Removing Spots from Binocular Glasses.—First ascertain whether the spots are attached to the polished surfaces of the lenses or have appeared merely in the Canada balsam which cements the lenses together. If the lenses have been attacked, and the application of methylated spirit does not remove the spots, then they will have to be repolished as follows:—Saturate a piece of muslin with spirit and rub over the surface, drying and polishing afterwards with a cambric handkerchief. If the spots are between the lenses of the combination, first draw a line with a lead pencil along the edge, to indicate the correct position of the lenses to each other; then heat them gently over a spirit lamp until the Canada balsam melts. Next separate the lenses and clean the surfaces as before. To cement the lenses together again, place a drop of the balsam in the centre of the concave surface; press the convex lens into place, moving it gently until the balsam is spread evenly all over and the pencil marks are together again.

Selecting and Testing Second-hand Field Glass.—A fair second-hand field glass ought to be got for something less than a guinea. Fully 75 per cent. of the glasses offered as second-hand are nothing of the sort, but are cheap articles, made up and sold to people who know nothing about field glasses. To test a glass, first look at the general get-up, and see if it is smart and showy or solid and well made. Then examine some object (a steeple or chimney

pots against a bright sky, or a signboard of white letters), and see if there is much colour; there should be none, or, at the most, the mere suspicion on the edge of the magnified image at the limit of the field. See also if the definition is clean and clear; there should not be fog. Look at a lamp-post or any other straight line, and see if it keeps straight in every part of the field. If these things are all right, test the glass for power. Look with the right eye through one tube only at some clearly defined object, and look at the same object with the left naked eye. With a little practice the real and the magnified image can be seen at the same time, and their diameters compared. The glass, to be of practical use, should magnify from three to five diameters. A simple test is to look through the glasses at a distance of from eighty to one hundred paces at the tiles of a roof. These should appear sharply and clearly defined, without distortion and without coloured edges. Another test is to make a number of black squares, circles, ovals, etc., on a white card, to be looked at at a distance of from eighty to one hundred paces; this is the severer test, owing to the contrast between the black of the figures and the white of the card. Then examine the lenses. These should be mounted in threaded cells, with the glasses removable. In common glasses the lenses are mounted in a brass cell, the edge of which is turned back to retain the glass permanently in position. The object-lenses should, of course, be achromatic, and the larger they are in diameter, if otherwise good, the better. A slight scratch is of no importance—it keeps away only an infinitesimal quantity of light; but if the polish is dulled it is another matter. When an instrument is described as eight-lens, ten-lens, etc., it indicates the number of lenses it contains. An eight-lens instrument would probably have in each ocular an achromatic objective consisting of three lenses cemented together, and a one-lens eyepiece, making a total of eight. In choosing an instrument, one fact might be noted. Amongst the cheaper glasses it will sometimes be found that the definition and achromatic correction are good, but everything seems somewhat misty. In really good, though rather more expensive, glasses this, of course, is absent.

Osiers

Osier-cutting may be begun directly the leaf has fallen. In some districts osiers are cut even in October, but, principally in the eastern counties of England, cutting is carried on mainly in December, January, February, and March. The heaviest cutting is done in January and February, and it is best to finish the work by the middle of March. The osiers are sorted into various grades, principally reds for peeled work and browns for unpeeled work. This sorting needs practical experience before one is sufficiently expert to detect all the rods, as there is a very large variety of osiers. The following are some of them: Green holland, brown holland, white holland, Welshers, Spanish, yellow canes, thin rods, stout rods, and two-year-old rods; the last named are used for large crates and heavy work. These names vary in different districts, so it is difficult to identify the varieties by name only. The rods are distinguishable by the buds, which are short and plump, similar to a young bearing bud of a plum tree. When cutting, leave 2 in. or 3 in. on the stubs to allow sufficient shoots for the next year's crop. The rods are tied in bunches when cut, and laid on old logs of wood or old faggots in piles six or eight deep; these should be turned about two or three times to weather, and should be ready for stacking in May. Rods which are selected for peeling should be tied in bunches, and stood with the stub ends in water directly they are cut. They are often stood in ditches where there is water a few inches deep. They must be kept in water at least 3 in. or 4 in. deep. Rats must not be allowed to bite the bark. If these are present in large numbers, they must be exterminated, or another place selected where the rods will be free from attack. The object of standing them in water is in order that they may spring and fill with sap for easy peeling. They should be ready for peeling by the middle of April—perhaps a little sooner, if the spring is fine and warm—and peeling is

continued until June; the work is sometimes done by hand, but it is tedious and slow work. A peeler—or brake, as it is called locally—used in one district leaves the worker with both hands free, to hold and draw the rods through. When the rods are peeled, they must be thoroughly dried, but not scorched, in the sun. They must not be allowed to get wet; even light showers must be avoided, as the rain turns them spotty, and discolours them. They should be stored in a dry loft or warehouse, fairly well ventilated. If they are peeled, dried, and stored in a proper condition, they will retain their whiteness for a long time.

Ostrich Feathers (*see* Feathers)

Otter Skins (*see* Skins)

Oven

Cracked Oven.—The cracking of a cast-iron oven is not at all uncommon, and is often brought about by the oven being screwed up or fixed too tightly so that there is no give-and-take to the movements of expansion and contraction. All good ranges now have wrought-iron ovens. Covering the crack with a plate of iron bedded with putty, then screwing on, will make a lasting job. If the crack is not easily got at, then a sound, if not good-looking, job can be made by plastering over the fissure some Purimachos fire-resisting cement.

Overmantel, Fixing (*see* Plugging Walls)

Oxidising

Oxidising Binocular Tubes (*see* Optical).

Oxidising Brass, Bronze, and Copper.—The metal is silver-plated and then treated by one of the methods described under "Oxidising Silver," on p. 390. (*See also* main heading "Bronzing.")

Oxidising Brass Black.—A good black, fairly durable, can be obtained by the optician's method. Thoroughly clean the work and, as far as possible, take it to pieces. Then immerse it in a solution consisting of 1 part of silver nitrate and 3 parts of copper nitrate. Finally heat the work over a flame or on a sheet of metal until the colour comes on. Brass can be rapidly oxidised by heating it with an electric current, or by making it the anode in a solution through which a current of electricity is passing, but the effects thus obtained would not be found suitable to all purposes. Brass can be blackened by coating with a thin layer of platinum deposited from a weak solution of platinum chloride without the aid of a battery or other generator of electricity.

Oxidising Iron and Steel.—The following three methods are given in an American work dealing with the manufacture of black oxidised watch cases. The first method is as follows:—Dissolve together chloride of bismuth 1 part, bichloride of mercury 2 parts, copper chloride 1 part, hydrochloric acid 6 parts, alcohol 5 parts, and water 5 parts. Thoroughly cleanse the articles in a soda bath, next dip them in spirits of wine and, after drying, immerse in the solution or apply it with a brush, and again allow to dry. Then boil for half an hour in boiling water. If not quite black enough, apply two coats. The second method is as follows:—Take crystallised ferric chloride 2 parts, solid butter of antimony 2 parts, gallic acid 1 part, and water 5 parts. Dip the article in this solution, and afterwards in a dilute hydrochloric acid bath. Allow the article to stand for twenty-four hours, and remove the coat formed with a steel scratch-brush. Repeat this operation till the article is black enough, afterwards dip in linseed oil and heat over a clear fire to a red heat, and finally rub on linseed oil. The third method is to make a solution of potassium bicarbonate, 1 part, in 10 parts of water. Immerse the article in this solution, dry in the air, and afterwards hold for about two minutes over a clear fire. Repeat this operation, when any shade of black may be obtained.

Oxidising Nickel.—There is no satisfactory method of oxidising nickel. The simplest plan would be to give the articles a wash of silver by deposition, and then oxidise them by means of sulphide of antimony or any other equally efficacious sulphide. The articles should be coated with transparent lacquer, such as Zapon, to preserve the shade. If the nickel is low

in nickel and high in copper, a shade nearly approaching black, similar to that of farthings freshly sent from the Royal Mint, may be obtained by boiling for a short time in hyposulphite of soda solution, and then shaking for thirty to forty-five minutes.

(*See also* "Nickel—Black Nickelling Process.")

Oxidising Silver.—There are many methods of oxidising silver. The articles, which should be cleaned, may be dipped in a solution of 2 dr. of sulphide of potassium to 1 pt. of water, heated to a temperature of 170° to 180° F. If the articles are left in for a few moments they become of a blue-black colour. If a brown shade is required, they may then be dipped in a mixture of 2 parts blue vitriol, 1 part of sal-ammoniac, and 20 parts of vinegar. The surface may be brightened after oxidation by brushing with a scratch-brush. Ammonium sulphide may be used in the place of potassium sulphide. Another method is as follows:—Warm the article, and apply by means of a camel-hair pencil the following solution: 2 dwt. each of sulphate of copper and ammonium chloride, and 1 dwt. of nitrate of potash dissolved in a little acetic acid. The article is then exposed to sulphur fumes in a closed box. A coating of wax will protect those parts of the work that require to be left unoxidised. A third method is to boil the articles for a few minutes in 10 oz. of water, 5 dwt. of potassium bromide, and 5 gr. of bromine. The polishing may then be done with rouge.

Ozokerite (*see* Paraffin Wax)

P

Packing Instruments for Transportation

PACKING delicate instruments for transportation is difficult work; an American method, described in "Popular Astronomy" by Prof. Todd, is :—Pack the instrument all round with cork sawdust closely confined in cloth bags of various shapes and sizes. The cork dust may be obtained from grape importers; all mechanical impurities should be removed, and then it should be washed and dried thoroughly. In washing, the cork must absorb as little water as possible; a good plan is to put not more than two or three quarts at a time into three or four times as much lukewarm water; press it under and rub between the hands, when the loosened dirt will sink and the cleansed cork will float. Skim it off, squeeze or drain, and spread out in sunlight to dry. The closely stitched cotton bags are filled nearly as hard as a pincushion, and generally are of small size, but for packing a large lens two squares, each divided into several compartments, furnish good protection. Tubes within others may be separated by long, narrow bags bent into rings. The advantages of washed cork for packing are elasticity and freedom from dust.

Paint and Painting

Paint Materials.—White-lead (for full description of which see "White-lead") is the base of most oil paints, because it possesses greater covering properties—body—than any other pigment. Zinc white is often used as a base also. Colour mixed with it will not be so likely to fade as when mixed with lead; but it tends, however, to chip and crack, rendering the addition of lead necessary in most cases. Red-lead is an exceptionally good base for paint to be used on iron work. The natural earth pigments are preferred for tinting purposes; raw umbers, raw siennas, etc., last longer than burnt umbers, burnt siennas, etc. As a rule, burnt umber should not be used for outside painting, but the required shade should be obtained by mixing lampblack and an oxide colour, such as Venetian red. Common colours include lampblack, red-lead, white-lead, Venetian red, umbers, and all other common ochres, such as greys, buffs, stones, etc. Superior or ornamental colours include bright yellows, warm tints, blues, mineral greens, etc. All blue pigments are not chemically suitable for mixture with yellows or reds, nor all yellows with reds. For mixing with oil-colour paints, chrome is undesirable, and it is particularly to be avoided when compounding greens from Prussian or Antwerp blues, which colours it would eventually destroy. In such an instance, for common use, the best substitute for the chrome would be bright yellow ochre, or, as it is often labelled, yellow paint. Raw sienna can also be used with the above blue pigments without much detriment to either. In any case where a bright mixed green is absolutely necessary, the lemon chrome can be used in conjunction with good ultramarine blue. Linseed oil is used in paint in two forms, boiled and raw. Boiled oil is a capital drier, especially for outside work, retaining its gloss and wearing well; it dries more quickly, and less of it is required for binding the paint than is the case when raw oil is used. It is, however, liable to become brittle

and to crack on exposure to air, and so, for outside work, a small proportion of raw linseed oil should be added to increase the elasticity; especially take this precaution for ironwork, on account of the great amount of expansion and contraction to which that material is subject. Boiled oil is generally used for outside work, raw linseed oil for inside work. Boiled oil is, in effect, a kind of low-grade varnish. It has been used with good results instead of varnish for outside grained work. Turpentine is used in paint to hasten drying and to help the oil and the pigment, as well as the several coats of colour, to combine to produce a flat which, without destroying the quality of the colour, hides the inequalities of the surface to which it is applied. For the finishing coat for outside work turps is used very sparingly or not at all. Paint dries by the absorption of oxygen, and to this end materials called "driers" are extensively added. Borate of manganese, which is a powerful drier, has 40 per cent. of oxygen in its composition, and is added to linseed oil in the course of boiling to increase the drying qualities. Boiled oil of itself would not be a more powerful drier than raw oil, were it not for the borate of manganese boiled in it. Many kinds of driers are available. Paste driers are in extensive use, but are not particularly recommended. Driers, it should also be remembered, tend to destroy the life of the paint, and therefore they should not be used in excess.

Paint Mixing.—In mixing paints, the easiest way is to use pigments already ground in oil, instead of dry powders. With a palette knife or a household knife, break up the lead rather stiff, adding a little linseed oil. Thin down the paint until it is rather stiffer than the whole will be when ready for actual application; or if dry pigments are to be used, add a little more oil, and thoroughly mix. The lead (white-lead or red-lead), zinc (zinc white), or other base being ready, add some pigment, and well stir. If several pigments are required to produce the tint, be sure to add only one at a time, and take great care that each is thoroughly incorporated before the next one is added. Add the pigment a little at a time. Some pigments, such as Prussian blue, are very strong, and the addition of too much will spoil the job. It is easy to add a little more, while it is impossible to take any out. Having mixed the paint, add a proportion of driers, and then pass the paint through a fine wire strainer. Mix up enough paint in one batch to do the whole of the job in hand, so that there may be no trouble or waste of time in matching tints. Paint mixed in cold weather is likely to be unsatisfactory, because the oil will stiffen and be more difficult to form into a perfect admixture. To remedy this, some of the oil should be heated, and this poured in will warm up the paint, and prevent it "pulling" when applied, and so avoid the unnecessary force required to draw the brush along. To mix up, say, 1 lb. of ordinary quality paint, take about 8 oz. of pigment the desired colour: thus, white-lead for white, light greys, pinks, cream, etc.; Venetian red or vermilion for red; and so on, according to the price and colour desired. Add to this about 2 oz. of patent paste or liquid drier; then make up to 1 lb. with either linseed oil alone or oil and turpentine in equal parts. Remember, the more oil the more drier is advisable, but never less than 1 part drier in 8 or 10 of entire bulk. If only casual pounds of paint are wanted, that sold ready mixed, at prices from 3½d. to 5d. per lb., would be cheapest, and should do for common inside work. A single pound could not be made so cheaply, and some of the colours sold—bright red, for instance—could not be made at twice the figure. If varnished, they stand a lot of wear. The cheapest of the ready-made paints are, however, very unreliable, and are likely to give trouble by not drying.

Preparing for Painting.—All work to be painted should be thoroughly dry, clean, smooth, and free from dust. In painting new wood, the first operation is "knotting," which prevents the turpentine exuding from the knots in the wood and so staining the work. "Patent knotting"—shellac dissolved in naphtha—is generally used. Knotting may also be done by coating the knots with a paste of red-lead, a little white-lead, whiting, and size. Knots are best covered with gold- or silver-leaf, secured with gold-size. Another mode is to cut out the knot to the depth of about ¼ in., dab some paint

into the hole and then fill it up with hard stopping, composed of white-lead with one-third of japan, and sufficient turpentine to make a stiff putty. This composition becomes hard in fifteen minutes, and is dry in twenty-four hours, when it may be rubbed down and painted over with confidence. Still another method is to cut out the knot altogether and fill with clear grained wood. Knots may be painted with hot lime, ironed with a hot iron when dry, and then painted smooth; or the lime may be left on for twenty-four hours, scraped off, and the place painted with red- and white-lead and linseed oil, and after this is thoroughly dry, smoothed with pumice-stone. Where time is more precious, the patent knotting above mentioned may be used. It dries in from five to ten minutes, forming a skin over the knots, thus allowing the painting to be proceeded with without loss of time. Priming, the next process, consists in laying the first coat of paint, the object being to render the surface less absorbent. This coat generally consists of red-lead, or red-lead and a small proportion of white-lead, raw linseed oil, and a little litharge; and a proper proportion of some other drier is also added. Red-lead has greater hardening properties than any other pigment used in painting, and, being applied to the work fresh from the carpenter's hands, the wood absorbs the priming readily, which gives it a harder surface as a basis for successive coats. To serve its purpose best, the priming coat should be of a deep salmon colour, and used much thinner than ordinary paint, the colouring matter being red-lead only. Priming must be done before stopping the work with putty, a material which will fall out when dry if applied to a fresh wood surface. The more white-lead used in priming, the better it enters the pores of the wood. For inside work, priming is composed of red- and white-lead ground, and mixed with linseed oil only. When dry, the work is rubbed down with glasspaper or pumice-stone. The next process is stopping, which consists of filling up and making good nail holes, cracks, joints, etc., with putty or a mixture of putty and white-lead. This operation is done with the stopping-knife.

Process of Painting.—Having made good all defects and seen that the work has been properly rubbed smooth, the colouring coats are next applied. Hold the brush at right angles to the face of the work so that only the ends of the hairs touch it, so as to force the paint into the pores of the material, and spread it evenly over the surface, without leaving streaky marks. In good work, each coat when dry should be well rubbed down with glasspaper or pumice-stone, and well dusted before applying the next coat. The brushes and all the utensils should be freed from all dry paint by carefully scraping with a knife and washing with warm water. The paint should be strained free from skins and all extraneous matter. In oil painting, the utmost cleanliness is requisite. With the ordinary paints, new wood or ironwork requires four coats, including the priming coat but exclusive of any flatting coat; and old paint should have two coats for inside and three for outside work. Let the second coat somewhat approach to the colour ultimately desired; dilute it with about one-third turps, let the third coat be mixed with equal parts of oil and turps, and let the fourth coat be mixed with one part oil and two parts turps. The second coat for new work is made up chiefly with oil, as it best stops the suction of the wood; but second coat for old work is made up chiefly with turpentine, because oil paint would not dry or adhere so well. By way of general direction when applying the colour, it may be stated that work should be covered with a brush not overcharged with paint; and when laying paint there cannot be too little of it in the brush, or it will ooze out in one place as it is taken up in another. Spread the paint as evenly as possible; and to effect this, as soon as a convenient space is covered, pass the brush over it in a direction contrary to that in which it is finally to be laid off. After this "crossing," lay off the surface softly and carefully in the direction contrary to the crossing; that is, with the grain of the wood, taking care that none of the cross brush marks remain visible. In laying off, the brush should begin its stroke on a part of the work already coated, so that there is no visible joining. Every coat should be perfectly dry and all dust carefully removed before the succeeding one is laid over

it. When the second coat is thoroughly dry and hard, rub down the work with glass-paper and carefully examine to see whether any further stopping or facing is required.

Venetian Blinds, Painting.—For repainting Venetian blinds, if the work is cracked, remove the old paint with a strong soda solution, rinse well, dry, give a coat of priming colour, and then paint as described on p. 393, under the heading, "Process of Painting." If, however, the paint is not cracked, rub down with No. $1\frac{1}{2}$ glasspaper, and apply one or more coats of spirit or sharp colour, made by first obtaining the colour ground stiff in turpentine, adding a little japan gold-size to fasten it; finish with a coat of hard church oak varnish. For cheap and rapid work some decorators use a quick-drying spirit varnish over one coat of spirit or sharp colour. A special combined paint and varnish for Venetian blinds is made by many paint manufacturers, the work requiring only one coat, which gives a hard enamel-like surface at small cost. For enamelling Venetian blinds green, a priming coat, specially prepared in order to give solidity to the work, is carefully mixed and applied. To make it, grind pure middle Brunswick green to a thick paste with turpentine, and thin down to a proper consistency with 6 parts of turpentine to 1 part of gold-size, which causes the green to dry with a dull surface. Give the blinds one coat, and, when thoroughly dry, flat down with No. 0 glasspaper, making the surface as smooth as possible, as the enamel afterwards shows up all inequalities. For the enamel, take pure middle Brunswick green (dry), 14 lb.; church oak varnish, $\frac{1}{2}$ gal.; outside copal varnish, $\frac{1}{2}$ gal.; japan gold-size, $\frac{1}{2}$ pt.; American turpentine, $\frac{1}{2}$ pt. Mix the green with the copal varnish to form a thick paste, and have this ground very fine, preferably by passing it twice through a small cone paint-mill. Test for fineness by rubbing to a very thin layer on a piece of glass, when the grit may be easily observed. Add the oak varnish and the gold-size, and thin down with the turpentine. One coat of this enamel, which possesses a good body and dries hard with an excellent gloss in about twelve hours, is sufficient.

Whitewashing and Distempering. — In mixing white distemper (whitewash), whiting is placed in a pail, just covered with water, and allowed to soak for an hour, the superfluous water being then poured off and hot size added. (The size should have been merely melted, not boiled.) It is usual to bare the arms to the elbows, and, plunging them into the pail, break up all the lumps with the hands. Strain the stuff, after mixing, through paperhangers' canvas. The addition of a little blue-black prevents the white distemper from changing colour. Any colouring matter mixed with the white should be added before the straining takes place. Double size, or Cannon's concentrated glue-size, is recommended for distemper; soak it overnight in water, so that it may be of the consistency of jelly, and then put it in a clean vessel with some water, to prevent it charring, and melt over a slow fire, with frequent stirring. There is considerable difference of opinion as to whether it is better to mix distemper with melted size or jellied size. Moderately hot size mixes thoroughly with the whiting, and if placed in a cool situation will form into a jelly in the course of one night. When the size has been used in the jellied state the distemper can be applied immediately. A little alum added to the colour causes it to lie level. When cold, the distemper should be of the consistency of thick paste. Should it then turn out to be too thick, it should be well beaten up with a little water. The wall or ceiling, whether new or old, is brought to a clean, even surface before applying the distemper. Cracks should be freed from dust or loose plaster, sprinkled with water, and filled with plaster-of-Paris and a small portion of whiting mixed with water in which a little alum has been dissolved. Old distemper must be soaked with hot water applied with a distemper brush, and washed off with a piece of coarse canvas, finishing with a sponge frequently rinsed in water. The surface must be thoroughly dry before the whitewash is applied. In cases where a ceiling has been patched, rubbing a little of the old washed-off distemper over the patch will keep it from drying whiter than the rest of the ceiling. Plaster is often painted before distempering, so that an old coat of distemper may be easily removed

before a new one is applied. A cracked ceiling is often successfully treated by lining with paper and whitewashing over this (*see* "Wallpaper: Papering Ceilings").

Paint, Aluminium (*see* Aluminium)

Paint, Gold (*see* Gold Paint)

Paint, Grease (*see* Grease Paint)

Paintings (*see* Pictures)

Pampas Grass, Dyeing

To dye pampas grass, place it in fairly strong solutions of coal-tar dyes, and heat until sufficiently coloured. The most suitable dyes are soluble blue, picric acid, fast yellow, eosine, magenta, methyl violet, malachite green, Bismarck brown, and acid brown. If, however, only small quantities are to be dyed, use Judson's or other dyes, sold in packets.

Pans

Repairing Cast-iron Pans.—Many persons have the impression that as soon as a cast-iron pan has a hole in the bottom it becomes quite useless, as such an article cannot well be soldered, and plating is altogether out of the question. Yet the utensil may be repaired in many instances in a simple yet effective manner, and its usefulness continued for a considerable length of time. Ream or bore out the hole carefully into a circular shape so as to remove all angularities, as these are apt to extend themselves and thus cause irreparable injury. Into the circular hole put a copper rivet, and carefully rivet it on both sides. Of course, this may be done with either a cold or hot rivet, though the latter will form the closer joint owing to the contraction of the metal on cooling. An iron rivet, even if heated, would require a much heavier blow than copper to close up the hole effectually, and there would be greater risk of damage, hence the softer metal is to be preferred.

Pantograph

Pantographs are instruments by means of which drawings can be copied on a larger or smaller scale. Simple wooden pantographs are sold for a few pence each. Another kind consists of a short length of round elastic of the best procurable quality, a large drawing pin, and a couple of pieces of any kind of thin sheet metal that can be cut to shape with a pair of scissors. The elastic may be, say, from 1 ft. to 3 ft. long, according to the size of the drawings it is intended for. A loop is made at one end, and through this the drawing pin passes, securing the elastic to the drawing board. To the other end of the elastic is fastened one piece of sheet metal—thin tin-plate will do—measuring, say, $\frac{1}{2}$ in. by 1 in. and rounded at the corners. Two round holes are made in this piece of metal—one for the attachment of the elastic by a knot, the other for an ordinary lead pencil to pass through. The second piece of sheet metal can be of the same size as the first, but should have a spear-shaped projection left at one part to act as a pointer. Two holes are required in this piece: one must be large enough to let the elastic pass through quite freely, the other must offer enough frictional resistance to require appreciable force to slide it along the elastic. To use the pantograph, the drawing pin has to be inserted near the upper left-hand corner of the drawing board; the picture to be copied is fixed down to the board, somewhat lower and towards the right. The pointer on the sliding piece of metal is adjusted to agree with that point in the picture which is nearest the drawing pin. To effect this adjustment, the elastic is stretched by pulling away the pencil, the point of which will at the same moment indicate where to mark a corresponding point for the enlargement. To bring the two points to relatively convenient positions, the elastic can be shortened by winding part of it on the drawing pin or by tying fresh loops till only the right length is left free. A reversal of the positions of pencil-holder and pointer, of picture and drawing paper, allows a reduced copy to be made. Any number of points in the drawing can be located by stretching the elastic till the pointer is at each required point in the original.

Paper

Air-proofing and Damp-proofing Paper.—Paper can be rendered both air- and damp-proof economically by dipping it in melted

paraffin wax. A soft paraffin wax of low melting point might be used; it is cheaper than the harder kinds, which have higher melting points.

Carbon Paper (*see* Carbon).

Dissolving Paper.—Paper may be dissolved by soaking it in strong sulphuric acid, in a concentrated solution of zinc chloride, or in a solution of ammoniacal oxide of copper. Paper may also be converted into nitro-cellulose by treating it with a mixture of nitric and sulphuric acids, and the nitro-cellulose thus formed may be dissolved in acetone, or a mixture of alcohol and ether, when it forms collodion.

Drawing Paper (*see* Drawing Paper).

Fastening Paper with Chemical Solution.—Glue or paste is best for sticking two pieces of paper together, but if these will not serve any special purpose, ammoniacal solution of cupric oxide might be tried. This may be made by precipitating a solution of copper sulphate with caustic soda, collecting the precipitate on a cloth, and, after washing once or twice with water, dissolving it in strong ammonia. This solution dissolves cellulose, and if applied to paper softens the surfaces so that two pieces when pressed together will become practically one.

Fixing Paper upon Nickel.—To fix paper upon polished nickel, either of the following recipes is available: (1) Dissolve 40 parts by weight of dextrin in 60 parts of water, add 1 part of glucose, and heat almost to boiling. (2) Dissolve 40 parts of dextrin in 40 parts of water. Now add 20 parts of water in which 2 parts of glucose and 1 part of sulphate of alumina has been dissolved, and heat it over a water bath to about 194° F. (90° C.), maintaining the heat until the solution is completely clarified.

Fixing Transparent Paper to Glass.—For sticking transparent paper to glass, use gold size, which may be thinned with a little turps, if necessary, to make it of proper working consistency.

Hard Paper Mass.—For converting paper into a hard mass similar to iron, the paper may be treated with dilute sulphuric acid as in the manufacture of parchment paper, and then submitted to very great pressure. Or, by the action of a mixture of nitric and sulphuric acids upon paper, a "nitro-cellulose" is obtained, which, on moistening with camphorated spirit and pressing, forms "celluloid," as fully explained under that heading.

Imitation Watermarks on Paper.—To produce a resemblance to a watermark, use a liquid consisting of equal parts of pure glycerine and water. Very transparent letters can be formed by writing with castor oil, but they are prone to spread into the surrounding paper after a short time. Copal varnish would serve better than castor oil.

Japanese Paper.—Japanese paper is known in many varieties, the chief of which are: (1) That made only from kozu; (2) from kozu or mitsumata, or from a mixture of the two; (3) from gampi; (4) from kosu, waste paper, etc. One of the strongest and thinnest of these papers is made from kozu only; it is yoshino-gami—filter-paper. Its chief use is in filtering lacquer, several sheets being placed together for the purpose. As it does not tear, the same paper may be used several times, and it is thus very economical in use.

Paper Pulp.—If large quantities of this material are required, it can be bought in the form of wood pulp, which is largely imported into this country from America, etc., for the making of paper. The ordinary class of paper pulp is made from rags, old paper, etc., by heating it in a revolving boiler with caustic soda. This agent disintegrates the fibres. The pulp is turned out and thoroughly washed in large tanks, it being then bleached by chloride of lime and acid, and again thoroughly washed. The paper pulp can very easily be made with a boiler; if white is wanted, choose waste white paper. For 1 cwt. of paper use 10 gal. or more of water, in which 3 lb. to 5 lb. of lime have been slaked, and while heating up add 4½ lb. to 7½ lb. of soda ash; during the boiling, break up the paper as much as possible with a wooden stick. After boiling for about an hour, ladle the paper pulp into a large tub of water, allow it to settle, and decant the clear water; fill up again with water, and repeat

this operation three or four times; drain off as much water as possible, and the paper pulp is then ready for any purpose required.

Paper Pulp, Stopping Cracks with.—For stopping cracks with paper pulp, the latter should be kept in a close-stoppered bottle, so that the moisture cannot evaporate. When required for use, thin with hot water, add plaster-of-Paris to make it slightly pasty, and use immediately. Mixed with glue and either plaster-of-Paris or Portland cement, paper pulp is the best stopping for cracks in wood. For cracks in floor-boards, mix the pulp with sawdust and then with glue dissolved in linseed oil. Apply the stopping, and when partly dry, cover with paraffin and smooth with a hot iron.

Paraffined Paper.—Paraffined paper can be obtained from any dealer in electrical apparatus. As, however, it can be easily and cheaply prepared, as required, almost all coil-makers prepare their own. This is done by placing some pure paraffin wax (obtainable from a dealer or druggist) in a pie-dish or a soup-plate, and melting it in an oven or over a saucepan of boiling water. When the wax has melted, take the sheets of blank post paper, or any other thin, tough, unsized paper, cut them to the required size, and immerse each sheet singly in the molten wax until well saturated. This is best done with a pair of forceps or clips, gripping each sheet at one corner, and lifting it up to drain off superfluous wax; then hang the sheets on a line to cool and harden. When cool, examine each sheet carefully, and reject those that show pin-holes or other flaws; use only those that are uniformly coated with wax.

Pasting Paper to Cloth.—Ordinary flour paste or glue can be used for sticking paper to cloth. Neither of these, if properly used, will crack or peel off. Presuming that the cloths to be pasted are tailors' or drapers' samples, glue is the best material to use. The glue should be good and should be used hot. It should be applied to the paper, not to the cloth, with a small brush or the finger. Daub a little glue on the place where the cloth is to be laid, lay on the cloth, and press it down with the hand (a few moments will suffice). With care a great number of samples can be glued on in a very short time without showing any dirty patches. Neither gum nor gelatine should be used for sticking the cloth. Paste will not crack or peel off unless used too thick or in too great a quantity; a daub is all that is necessary.

Removing Grease Stains from Paper.—Thoroughly moisten the stained parts of the paper with benzine or petroleum spirit; on this lay a piece of clean blotting p per, and over the latter run a warm iron. If the first treatment does not remove the whole of the grease, repeat.

Removing Ink Stains from Paper (*see* Ink Stains).

Splitting Sheet of Paper in Halves.—Those who collect prints for screen decoration and scrap-book making often come across a piece of paper which has on each side a picture that they wish to make use of, but, for the lack of knowing how to manage it, they are reluctantly obliged to be content with one and to paste the other down out of sight. Not only have many desirable pictures to be sacrificed in this way, but the printing on one side may be wanted as well as the picture on the other, or the reversed type on the pasted side may be so prominent through the paper of a scrap that its removal would improve matters very considerably. For many more reasons it is occasionally required to strip the two surfaces off a sheet of paper so that the following instructions for carrying it out will be found acceptable. Mix some paste as follows: Put a tablespoonful of clean wheat flour in a heap on a sheet of glass or other flat, hard surface. Make a cavity in the middle of the heap and pour a teaspoonful of clean cold water in. Then take a palette knife, or a very flexible table knife, and mix the flour and water very intimately into a paste, adding, a teaspoonful at a time, as much mo.e water as is necessary to leave it rather thicker than cream. Work this well with the knife till there is not left the slighte.t suspicion of lumpiness. Cut out a print, from the same paper if possible, but not the actual one it is required to split, in case it should

be spoiled at the first attempt. Take two pieces of clean, new calico, a few inches larger than the print. For a print 3 in. by 6 in., for instance, the calico may be 3½ in. by 9 in. With eight drawing-pins, put in at the corners, stretch the two pieces of calico on a flat board. Put the print in water for fifteen seconds; take it out and dry it with pressure between blotting paper, but leave enough moisture for it to be damp. The print will be dried sufficiently if it and the blotting paper are placed between the leaves of a large, heavy book, which is then closed upon it for a minute or two. Apply plenty of paste to the faces of the stretched calicoes, and do it evenly, using a brush of hog's bristles or fibre. Draw the brush over in every direction so as to get the paste well spread, but leave unpasted the 3 in. (or whatever it may be) of calico that exceeds the size of the print lengthways. Apply the print carefully to one piece of calico and cover it with the other piece, taking care to see that the pasted parts are in intimate contact with the print, that the edges agree all round, and that there is not a wrinkle anywhere. Place the sandwich thus made between two sheets of blotting paper, larger than itself, and put the whole under pressure for some hours till the paste is dry. An office copying press is as good as anything to keep the book pressed flat. A good way to quicken the drying process is to warm and dry the blotting paper at intervals, removing it from the press for that purpose. When dry, the calico with the print between it must be taken out of the book, and the two unpasted ends of the calico must be separated, so that one can be grasped firmly in the right hand and one in the left, but without bunching them up. Both hands must then be brought to the middle line of the chest, and both must be simultaneously parted sideways right and left. Do not hold one hand still whilst the other is drawn away from it; move both together at the same rate. One half of the print will then be found stuck to each of the calicoes. The two prints so obtained can be got off by soaking for fifteen minutes in cold water. It is considered safer for doing large prints to fold over the unpasted end of each piece of calico and sew it along to make a sheath in which to place a straight and rigid stick, just as a lath is inserted at the bottom of a calico window blind, only the stick must be much stiffer. The pasted calicoes can be much more readily separated when a firm hold of them is got in this way. Two such calicoes with sticks sewn inside along one edge are to be recommended, and if the prints are pasted so as to lie diagonally across the calicoes, they will commence to tear apart at one corner, and this is likely to ensure good results. When proficiency is obtained with trial prints, those more highly valued can be done. But it must be remembered that all papers do not split with equal facility. Boiled paste—mind it has no lumps—may have to be used for some classes of paper. The thin strippings should be pasted on sheets of white paper; this will show them up just as if they had been printed directly upon it in the first instance, and they will look quite as well, or better, if good backing paper is used.

Toughening Paper.—To toughen ordinary unsized paper, soak it in sulphuric acid (2 parts of acid to 1 part of water) for a few minutes, then thoroughly wash it with water containing a little ammonia until no trace of acid remains, and let it dry. This is "parchment" paper, and it is not much less pliable than the untreated kind.

Tracing Paper (*see* Tracing).

Transparent Paper.—To make paper transparent for tracing, or when utilising an engraving as a negative over other sheets rendered sensitive to light, an American trade paper recommends saturation with benzine. In a little while, the absorbed liquid is again dispersed by evaporation and no evidence of the treatment remains. Another way is to dilute an ounce of castor oil with once, twice, or thrice its volume of absolute alcohol, and to apply this to the paper with a sponge. When the alcohol has evaporated, the oil is left in the paper, which allows the finest lines in a contact print or engraving to be clearly seen through its substance. The oil can be washed out again completely with absolute alcohol.

Wallpaper (*see* Wallpapers).

Papier-mâché

Papier-mâché is made from paper pulp, which may be produced on a small scale by boiling white blotting paper with water, and beating it till it is disintegrated. On the large scale, papier-mâché may be made from white rags or wood pulp. The pulp should be drained as much as possible of its water, and then mixed in a kneading machine with about one-eighth to one-fourth its weight of whiting and just sufficient glue size to make it into a stiff paste. It may be moulded easily by hand pressure in a small screw press. For white papier-mâché all the materials should be absolutely white, and parchment size or gelatine should be used; but for coloured papier-mâché, glue size can be employed. The pulp can be coloured by any mineral pigment, as lampblack, ochre, etc., or may be tinted with aniline dyes. The pressed articles should be dried slowly, or they will not keep their shape. As papier-mâché, if kept in a damp place, would become mouldy, it is better to varnish or lacquer it, after applying a coat of size.

Drapers' Busts.—In making drapers' busts of paper, the process is the same as that adopted in making the best class of papier-mâché work. A solid core or mould of wood is obtained, and its surface well saturated with linseed oil. This is covered with unglazed paper (not cardboard), rather under medium thickness, the adhesive used being strong glue paste—that is, flour paste in which Russian glue has been boiled. The paper, cut into convenient strips, is pasted on both sides, and laid evenly over the greased mould, all creases and air-bubbles being carefully worked out with the hands. After five or six layers have been spread over every part of the mould, the work is set to dry for the night in a very moderate heat. When properly dried, all air-bubbles which may have formed are cut out, and the holes stopped with a stiff mixture of paste and sawdust, the latter being obtained by sawing and filing the paper work. All creases having been rubbed down with a file or glasspaper, another series of coatings is applied and stoved as before. It should then be strong enough for removal from the mould. The overlapping edges are pared away, and if the work clings to the mould in any part it may be cut through with a tenon saw. The severed edges are then glued together, and a fresh series of paper coatings, stovings, and dressings is carried out, and continued until the required thickness, say, ¼ in., is reached. After a rubbing over with glasspaper to make it take the oil more freely, the work is laid to soak in a bath of linseed oil for two or three days, and again dried in a moderately warm stove. It should now be thoroughly hardened, and can be worked and finished in the same way as wood, though superior to wood in the fact that it will neither shrink nor split.

Mouldings.—The following are instructions for making papier-mâché mouldings as used for theatrical purposes. Obtain some thick, coarse brown paper; tear it into small pieces 3 in. or 4 in. square, and soak them in cold water. Now make some good flour paste, and while hot, to half a gallon of paste add about half a pint of linseed oil and about half a pound of melted glue. Well mix these together. Now squeeze the water from the paper and paste each piece thickly on both sides, placing them one on the other to keep them moist. These pieces are taken up separately and pressed into the mould, which need not be filled level, but left hollow so long as the whole of the design is well carried out. Plaster-of-Paris is used for making the moulds. The design is first made in clay or cut in wood. Make a strong box a little larger than the model; pour into this box the wet plaster, and press in the model, having previously brushed the latter over with a little sweet oil so that it will not adhere to the plaster. When the mould is hard set, line it with oiled tissue paper before pressing in the papier-mâché; allow this to set well and get partially dry before turning out. The mouldings may be fixed with needle-points and glue.

Paraffin Oil

Paraffin oil is the commercial name for oil obtained by the direct distillation of an American petroleum. The name is also applied to an oil produced by the distilla-

tion of boghead coal, shale, etc., at a temperature lower than that used in gas manufacture. The name petroleum is given to a number of inflammable liquids found in many parts of the earth, including many countries of Europe, besides Canada and the United States, and formed by the decomposition of vegetable matter below the surface.

Cleaning and Painting Paraffin Oil Van.—Remove the oil by washing the van down with benzine or coal-tar naphtha. Two applications will be necessary. This will remove all traces of the oil, and the naphtha, being volatile, will evaporate, leaving a clean surface ready for painting. When mixing the paint for use, add ½ pt. of oak varnish to each 7 lb. of paint; this will assist the drying, and prevent the oil softening the paint. The work should then be given two coats of hard outside copal varnish.

Cleaning Paraffin Oil Barrels.—It is not certain whether paraffin barrels can be sufficiently cleaned to allow of their being used for storing drinking water, but there is no harm in trying to do so. First pass steam through the barrels, and well wash them out; then burn some sulphur in an old saucer, and turn a barrel end up so that the fumes of the burning material will penetrate it. To do this, one end will have to be removed, and the barrel supported on a stone so that air can get to the burning sulphur. Next give them a good washing with soda, and finally with water. If the interiors of the barrels are then washed with slaked lime, so as to form a clean, white coat, everything possible will have been done to sweeten them. In some parts of England paraffin casks are largely used for domestic purposes, and are purified by being filled with wet earth and put to stand in a river or other convenient water for a few weeks. This has the desired effect. Another method is to take the barrel into a field, remove one end, and put in a few lighted shavings. After the oil has been burnt out the barrel may be covered with boards and earth until the flame has disappeared. The charcoal formed by the partial burning of the wood in the interior of the barrel will be an advantage rather than otherwise. Still another plan is to take one end out of the barrel and leave it in the open air until all the paraffin oil has evaporated, then give the inside of the barrel a coat of slaked lime, thinned to a cream with water.

Deodorising Paraffin Oil.—It is not at all easy to render paraffin oil free from odour. (1) The oil in common use may be improved by standing in contact with animal charcoal for several days; if the odour is still disagreeable, add a few drops of rose water or any other scent desired. Deodorised paraffin is often required for use as a hair restorer; vaseline is largely used as a pomade, and, being one form of paraffin, ought to do just as well as paraffin oil for the purpose named. (2) One of the most recently discovered methods of deodorising paraffin is to shake it with chlorinated lime in the proportion of about ¼ lb. of lime to each gallon of paraffin, with the addition of a little hydrochloric acid. After being shaken vigorously for some time, the liquid is removed to another vessel containing lime, and again shaken until all the chlorine odour has been removed. After standing, the liquid is decanted. Other methods are as follow: (3) It is mixed with about 3 per cent. of chloride of zinc, shaken well, caustic lime is added, and the whole is allowed to settle, the oil then being decanted. (4) It is mixed with 1 per cent. of acetate of amyl (pear odour). (5) It is mixed with from 2 to 3 per cent. of chloride of lime and a little hydrochloric acid. (6) 1 cwt. of the paraffin is agitated for an hour with 1·65 lb. of litharge, 10 lb. of quicklime, and 2¼ gal. of water. The decanted oil is well washed with water. (7) It is treated with reducing agents, such as powdered zinc or stannous chloride, being afterwards filtered through animal charcoal. The charcoal is washed and made fit for use again with acetone, the latter itself being purified by distillation.

Paraffin Oil Lamp (*see* Lamps).

Paraffin Paper (*see* Paper)

Paraffin Wax

Paraffin wax is known simply as "paraffin." In the distillation of Scotch coal shale, various hydrocarbons are produced, ranging from gaseous substances to solid

products. The greater part of the distillates are liquid oils of varying densities, and the heavier oils which pass over towards the end of the distillation contain a large quantity of solid paraffin in solution. By cooling these oils the solid paraffin separates, and is filter-pressed to remove the oil; this forms "soft scale" paraffin. This is moulded into slabs and heated in specially constructed rooms at a regulated temperature, when the more fluid portion melts out and runs off; after again pressing, the product is "hard scale" paraffin, which melts at a much higher temperature. By heating at a still higher temperature and again pressing, waxes of higher melting points may be obtained. Paraffin wax is also now obtained from American crude petroleum by treatment similar to the above. Cerasin is obtained from a natural hydrocarbon called "ozokerite," found principally in Galicia, where it is mined. The ozokerite is purified by heating it with concentrated sulphuric acid, and then washing with water. It is melted and moulded into slabs and separated by regulated heating into products of different melting points in the same way as paraffin wax. Cerasin is usually more or less artificially coloured in various shades of yellow and orange. White cerasin and paraffin wax are prepared by destroying the colouring matter with sulphuric acid, or by dissolving it out with naphtha, and then thoroughly bleaching by heating in contact with animal charcoal (boneblack, etc.) in a steam-jacketed pan.

Bleaching Paraffin Wax.—(1) Melt and stir in a quantity of finely pulverised animal black. The wax should be kept melted till the whole of the black has separated; the latter will carry out the colouring matter. (2) Paraffin wax is bleached by mixing it with a little strong sulphuric acid and heating to 150° C.; this treatment chars the colouring matter without affecting the paraffin in any way. The mixture is allowed to cool down, water is added, and i is then boiled; the paraffin wax rises to the surface, and on cooling again it may be removed as a cake, rinsed with water, and then dried. A perfectly colou less paraffin is obtained by filtering this treated paraffin through animal charcoal in a steam-heated jacketed cylinder.

Hardening Paraffin Wax.—The addition of stearin—stearic acid, as used by the candle-makers—to paraffin forms a moderately hard mass which has a higher melting point than paraffin alone. Carnauba wax forms a very hard product when mixed with paraffin, and raises the melting point considerably. The more Carnauba wax added the harder it will be, and the higher the melting point. The addition of cerasin or resin would also serve. If the latter is used, it must be melted first and the paraffin wax added to it.

Melting Point of Paraffin Wax.—The melting point of paraffin wax varies with different samples, the highest grade having a melting point of from 135° to 140° F.; this, however, is used but rarely and is made only for special purposes, says G. H. Hurst in the "Oil and Colourman's Journal." The grades of paraffin wax are designated commercially by their melting points. Thus, there is "120° wax," "115° wax," "110° wax," and "100° wax," the last being very soft and not much used in candle-making. To determine the melting point a rather neat method is recommended. Take a short length of glass tubing $\frac{3}{16}$ in. in diameter and draw it out slightly in a flame, breaking off the drawn-out part so as to form a pipette. Melt some of the wax and dip into it the drawn-out tube, in which, on removal, a small quantity of wax will remain. Allow this two or three hours to become quite cold and then tie the tube to a thermometer with the end containing the wax against the bulb. Half fill a glass beaker with water, support the thermometer and tube in the water, and gently heat over a Bunsen or spirit lamp. Carefully watch, and when the wax loses its opaque appearance and runs up the tube owing to the pressure of the water, the melting point of the wax may be said to occur.

Removing Water from Paraffin Wax.—If the quantity of water is fairly large, it may be removed by melting the wax and keeping it in a tall cylindrical vessel for some time at a temperature above the melting point. The water will settle out and the clear wax can be run off, or the water

taken out by a tap at the bottom of the cylinder. Traces of water can be removed by stirring in a small quantity of powdered dry carbonate of potash; this will absorb the water, and carry it to the bottom so that the whole of the paraffin can be decanted.

Solvents for Paraffin Wax.—Paraffin wax is soluble in ether, petroleum ether, benzine, chloroform, and carbon bisulphide. It is much more soluble in these when hot than cold, and therefore separates out again on cooling. It is probably more soluble in ordinary paraffin oil than in petroleum spirit, and if a little petroleum lubricating oil is dissolved at the same time, it will be found a help in preventing the wax separating out on cooling.

Paraform

This is the dry form of formalin, as explained under that heading.

Parchment

Drum-head Parchment.—The following is the best way to preserve and clean a goat's skin that is to be used for a drum head. The skin should first be soaked for several days in a solution of lime and water, and the hair removed by shaving with a sharp knife. The skin should then be nailed tightly, flesh side out, to a board, and the fleshy and rough parts removed; this may be done with a close-set spokeshave and a steel scraper. The skin should next be sprinkled with chalk and rubbed down with a smooth piece of pumice-stone until perfectly smooth, the refuse being washed off; it is then allowed to dry. It may be again rubbed down with smooth pumice-stone, after which it should be taken off the board and again nailed on, but with the hair side out, any roughness on that side being also smoothed with pumice-stone. The skin should finally be removed, and worked backwards and forwards over a round piece of wood till it becomes supple and smooth.

Fastening Parchment to Polished Surfaces.—To fasten parchment paper to polished surfaces employ the following cement, which, when made, should be kept in well-corked bottles: Macerate in a small quantity of water in separate vessels 4 oz. of gum arabic and 1 oz. of gum tragacanth, and well stir the latter, when it gets swollen and softened, until it is homogeneous throughout. Mix the two gums and filter the whole through linen, and then add slightly more than 1 gill of glycerine, in which 0·9 oz. of thymol has been dissolved. Add water to bring the bulk of the whole up to about 1¾ pt.

Laying Colour on Parchments.—When the plans on deeds (parchment) are coloured so that the colouring is a flat wash of water colour over a large surface, a little fine whiting should be rubbed over the parchment, and the surface dusted over; the colour can then be laid on evenly, provided the colourist has had sufficient previous practice in colouring ordinary drawings. If the parchment has been handled much, a little oxgall mixed with the colour will make it go on more evenly. Very old or badly prepared parchment may show spots where the colour goes through. The skin should be left lying flat after colouring, and not dried before a fire. Do not attempt to colour on parchment until sufficient practice has been obtained to do perfect work on drawing-paper. Some draughtsmen cannot colour without causing even the paper to cockle.

Parchment Paper.—Paper is parchmentised by passing it through a bath of weak sulphuric acid. The acid in the paper must afterwards be neutralised by passing the paper through an alkaline bath or through water. Adding the acid to the pulp in the heating process would not have the same effect as the acid bath, because the acid must act on the surface of the paper.

Removing Blood Stains from Parchment.—Blood stains should have been removed in the process of manufacture, as in the finished parchment they may not be amenable to any of the ordinary methods of treatment. In the manufacture of the finer classes of leather (such as calf for bookbinders, and various skins for glovemakers), also of parchment or vellum, after the unhairing process, and before dressing, the skins are subjected to a bath of dog's putrid dung mixed with tepid water. This

mixture is said to remove all fat, grease, and other stains. Manufacturers have tried to find a substitute for this unpleasant mixture, but have not succeeded. It is thought that the bacteria created by the putrefaction has some special effect not to be otherwise obtained. The following may also be tried: Immerse the parchment in a solution of acetic acid and gently rub the stained parts while wet with lump pumice on a flat board, then bleach with chloride of lime. This is said to render the parchment white enough for bookbinding purposes. The parchment may also be subjected to a bath of salt of lemons (equal parts of citric acid and cream of tartar). These acids may have on the parchment a hardening effect, which is of course detrimental, so caution must be observed in their use. Animal parchment, or vellum, as the heavier qualities are called, should always be carefully treated, as it is very liable to become stained. In the manufacture of parchment, it is almost impossible to remove the natural bloodstains, and when these are very apparent it is not unusual for the manufacturers to treat the skin with some whitening substance of a chalky nature to hide the blemishes. When the skin is damped with water, this white substance is washed off, and the original stains appear. Should this happen, it will be advisable not to attempt to remove the stains, as this will only make matters worse. Possibly, however, the water or sponge used for damping may not have been clean, and surface stains may have been caused. In this case make a weak solution of oxalic acid in water, and with a clean sponge go carefully over the entire skin. But first ascertain whether the colours or ink will be damaged by washing. To do this, with the tongue touch some part of the parchment having a large amount of colour, lay a piece of white blotting paper over the damped portion, and rub it with the thumbnail; if, on being lifted, the blotting paper is found to be clean, the work may be washed. But if the colour comes away on the blotting paper, the washing should not be proceeded with. In any case, great care must be taken; the work must not be rubbed with the sponge, but th's is passed swiftly over the entire surface, taking care that one portion does not get more washing or damping than another.

Removing Grease Stains from Parchment.—Grease stains can be removed with benzine. Make a small pad of cotton-wool, saturate it with the spirit, and rub quickly and lightly over the entire surface of the parchment. When it has dried off, the grease stains should have disappeared. If not, repeat the operation, and be careful not to rub hard, as this spoils the surface.

Removing Paint Marks from Parchment.—Put some benzine on a piece of flannel and apply to the skins, taking up the paint as soon as it is soft, and not smearing it over the skin. Finish with a little soap and water; finally rub the skin with glycerine.

Removing Tea Stains from Parchment.—Tea stains are very difficult to remove from parchment. Try oxalic acid, and if this fails it would seem hopeless to try further. The parchment may be dyed one colour; this would help to hide the stains. Make a weak solution of permanganate of potash and wash the leaves over carefully with a sponge. This will give a good brown colour not unlike the tea stain. When all the leaves have been treated on one side and are dry, turn the book over and treat the other side in a similar manner. Parchment is a very troublesome material to wash owing to the greasy nature of the surface, and also to its liability to cockle when drying. If each leaf could be pinned down to a board when applying the stain, and allowed to dry while still pinned down, the job would look better.

Vegetable Parchment.—There are now doubtless many methods of producing the vegetable parchment which is so extensively in use for covering preserve pots, for packeting tea and coffee, as tracing paper, and for many other purposes; but the original method is still employed. In 1841 a civil engineer, Mr. W. E. Gaine, made experiments with the object of producing tracing paper without employing any oily matter. He then discovered that sulphuric acid had a remarkable action on paper. Ten years afterwards, while seeking to improve paper

used for photographic purposes, Mr. Gaine ascertained that diluted sulphuric acid has a remarkable effect on blotting paper—that is, on the unsized paper technically known as waterleaf. The sulphuric acid of commerce (popularly known as oil of vitriol), having a specific gravity of 1·845, was diluted with half its bulk of water, and blotting paper dipped in this solution became converted in a few seconds to a gelatinous sheet, which, on being passed through clean water in order to remove the acid, assumed the characteristics of vegetable parchment,

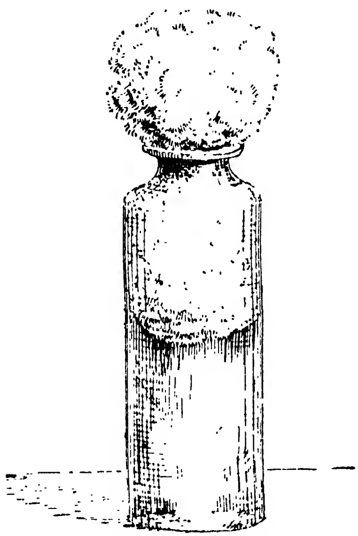


Fig. 490.—Paste Brush made with Bottle and Sponge.

which is tough, elastic, and skin-like. Repeated washings in water removed nearly all traces of acid, and those that remained were converted into inactive and harmless sulphate of ammonia. Extreme caution was found necessary in preparing the solution of acid and water, for these fluids, on coming together, evolve great heat, and on one occasion the great amount of steam given off caused the acid to spurt towards the face of the operator; such an accident might prove disastrous. It is necessary that the proportions of the acid and the water should be nicely adjusted. If the mixture is too strong, that is, contains too much acid, the paper is charred; if too weak, the paper is dissolved.

Paste

Paste Brush.—A paste brush costs only a penny or two. For mounting photographs, pictures, or any other small work for which paste is used, the brush illustrated by Fig. 490 is said to be far better than the common kind. The paste goes on smoothly; it avoids an excess and retains its supply; when placed on the table it stands up, and when the work is done it is easily cleaned. Its construction needs but little explanation, all that is required being a small phial. Into this stuff two parts of a piece of fine sponge, leaving about one part exposed; the exposed part can be pushed in or pulled out to vary the size required, but the greater part should always be kept inside. Being able to stand it on end is no small advantage.

Almanacs, Paste for Mounting.—Ordinary flour paste should be suitable for the purpose indicated. Mix best flour with water to a smooth batter, then add boiling water, stirring all the time, until the paste thickens. Boiling the paste is, by some, considered an improvement; but if this is done, add a little more water, and keep the mixture well stirred to prevent burning and the formation of lumps. Ground rice may replace the flour, and makes a paste somewhat more starchy in character. For a stronger paste for use in mounting stout material, a portion of hot clear glue may be added to flour paste whilst still hot, with which it should be thoroughly incorporated by stirring. All paste should be strained; and if it is wanted to remain sweet for a week or more, a little carbolic acid or oil of cloves should be added. Alum, which is used by paperhangers, will also answer as a preservative.

Bill-posters' Paste.—Bill-posters' paste may be made by beating half a quartern of wheat or rye flour with a little cold water. Pour slowly into this a gallon of boiling water, stirring the while until it thickens. The paste should be made in a galvanised pail, which should then be placed on the fire for a minute, the paste being continually stirred. For use, thin with cold water. A

tablespoonful of powdered alum should be put in with the flour. For a bill-posters' paste that could be thinned down as required, mix powdered gum tragacanth with a little warm water to a paste, and dilute with cold water; 1 lb. of gum tragacanth will yield a strong gum with 10 gal. of water. A concentrated paste may be made by mixing common starch with a little water in a bowl, and then pouring about five or six times its weight of boiling water on it while it is being vigorously stirred; this forms a stiff jelly, which may be readily thinned for use by admixture with warm water.

Bookbinders' Paste.—Paste as used by bookbinders is made thus:—Put a teaspoonful of best white starch into a cup, and make into a creamy paste with cold water; then pour boiling water over the starch, stirring quickly. When cold, squeeze through a piece of fine muslin.

Damp-resisting Paste.—A damp-resisting paste for hanging wallpaper to wood or masonry may be made, states an American authority, by mixing rye flour with boiling water and adding to every 60 parts (by weight) of the boiling mixture 1 part of good linseed oil varnish and 1 part of turpentine.

Gilt Paper, Paste for.—Paste for gilt paper should be made of good wheaten flour, and should not contain alum, which darkens the gold.

General or Office Pastes.—(1) Dissolve about a teaspoonful of powdered alum in about 1 qt. of water, and stir in enough flour to make a thick even cream. Then stir in a teaspoonful of powdered resin, and pour in a cupful of boiling water. After stirring, pour the whole into a convenient earthenware vessel, and add a few drops of oil of cloves. (2) Steep about ¼ lb. of small pieces of gelatine in about 1 lb. of water till they are soft. Then heat the whole to dissolve the gelatine, and pour into the mixture, while still hot, about 2 lb. of flour paste and 1 pt. of water. Heat this till it boils, and when it has thickened and is cooling, stir in a small quantity of silicate of soda and a few drops of oil of cloves. (3) Ordinary gum paste is made from equal quantities of picked gum arabic, white sugar, and water. The solution is evaporated till it is thick; then about three whites of eggs added per pound of gum. These should have been previously beaten up in a vessel. The whole is then strained through muslin, and evaporated until it will set. (4) Dissolve a heaped-up teaspoonful of powdered alum in a breakfastcup of cold water, and with this alum water mix the paste, crushing all lumps with a flat piece of wood. Boil slowly, stirring until the stick will stand alone. This paste does not become mildewed or offensive. Do not cover up too tight, and do not keep it in a tin, or put a tin-mounted brush in it, because of rust. (5) A quick-drying paste is made by mixing 100 parts of flour paste with 5 parts of dextrin, or equal parts of glue and paste. (6) There are several materials from which an adhesive paste or glue for securing labels could be made. By treating gum arabic with water; by treating dextrin (British gum) with water; by boiling glue for several hours with water, borax, and carbonate of soda, or by using fish glue. The first method is by far the best, yielding a stronger gum than any of the others. (7) Ordinary flour paste, made with the finest wheat flour and a small quantity of fine white sugar, keeps good for any length of time if a few drops of carbolic acid are added. (8) Four parts (by weight) of fine glue are softened in 15 parts of cold water, and then moderately heated until the solution becomes quite clear; 65 parts of boiling water are now added, with constant stirring. In another vessel 30 parts of starch paste are stirred with 20 parts of cold water, so that a thin, milky fluid is obtained without lumps. Into this the boiling glue solution is gradually stirred, and the whole boiled for a short time. After cooling, a few drops of carbolic acid are added as a preservative. This paste may be used for leather, and if preserved in corked bottles will keep good for years. (9) A paste possessing good keeping qualities is made by adding 15 grains of corrosive sublimate to a pint of ordinary flour paste. Of course, corrosive sublimate is a deadly poison, and must be handled with the utmost care.

Preservatives for Paste.—Alum is a moderately good preservative for paste, though

not absolutely protective; the paste should be kept in a dry place in a closed bottle. A very small quantity of oil of cloves, carbolic acid, or corrosive sublimate will prevent mould forming; a mere trace of these only should be used on account of their poisonous nature. Mercurous chloride or calomel cannot take the place of corrosive sublimate because, being nearly insoluble, it is not so poisonous as the sublimate, and therefore not nearly such a good preservative. Formalin is sometimes employed.

Shoemakers' Paste.—(1) To make shoemakers' paste, put some rye flour in a pot, pour on boiling water, and well stir. Do not pour on much, as the secret of making good paste is to make it as stiff and firm as possible. There must be no lumps, so, as there is such a little water added, the paste requires a lot of stirring, and even after it is cold and ready for use, an occasional stir greatly improves it. Sometimes dextrin is added to shoemakers' paste. (2) Take 3 oz. of glue and break it up very fine; fold it in a cloth and bruise it with a flat iron. Now place the glue in a vessel with $1\frac{1}{2}$ pt. of water, near the fire, let it thoroughly dissolve, then pour the mixture in an iron pan, and add sufficient seconds quality flour to form a creamy consistency. Boil for half an hour, constantly stirring, and when lifted from the fire add a teaspoonful of powdered alum or a few drops of oil of cloves to keep the mixture fresh keep stirring until quite stiff.

Pastilles (*see* Deodorising Pastilles and Fumigating Pastilles)

Patent Leather (*see* Leather)

Pearl and Pearls

Cleaning Pearls.—For cleaning pearls, one safe method is to wash them in lukewarm water with light suds made from white Castile soap, and then to dry them by shaking in a box filled with jewellers' sawdust, for if left wet the gems may be injured. To free the setting round a pearl from dust, a soft-bristled tooth-brush should be used, for nothing but fine hairs can get into the small corners and clean the prongs without danger of loosening the jewels. In cleaning a pearl ring or scarf pin surrounded by a cluster of diamonds, the best plan is to put the article into a bowl of clear lukewarm water. Next dip the brush in the water, rub it over a pure toilet soap, and make a thin suds on the hand; then brush the jewels and setting carefully until they look clean. Care must be taken that no bits of soap get on the gems. Occasionally they will have to be soaped several times to make them bright. The moment the dirt is removed, rinse them in lukewarm water and blow it off quickly, so that the pearl will dry more rapidly when put in the sawdust. Drop them in a bowl filled with jewellers' sawdust, and shake them gently for several minutes. When taken out, if any fine particles of wood cling to the setting they should be whisked off with a small, soft, dry tooth-brush, leaving the pearls and diamonds bright and lustrous. Some people prefer using alcohol instead of box sawdust to dry the stones, but unless this is used exceedingly carefully, the setting may be loosened. Dip the ring just once in alcohol and quickly blow or brush it dry. The whole process of cleaning pearls should not take more than from six to ten minutes, and should be done every two or three weeks when they are constantly worn.

Deterioration of Pearls.—Pearls are liable to deterioration from various causes. The acid secretions of the skin, foul gases, salt water, and soap injure them, and sudden changes of temperature may cause them to crack, or even to burst. In the course of time the pearl becomes dull, or "old," to use the technical term. When it has completely lost its lustre it is said to be dead. Attempts have been made to restore the lustre of dead pearls by various methods, none of which produces very satisfactory results. The most curious of these methods consists in feeding the pearls to fowls, and killing these after the superficial layers of the pearls have been removed in the process of digestion. They may be improved by washing in lukewarm water and light suds, and drying quickly in sawdust or alcohol, or boiling for fifteen minutes in milk. Another method is to place them in a linen strip, sprinkle with salt, and set in warm water until the salt is extracted. Baking

the gems in a loaf of barley dough is another means. If the pearl appears almost lifeless, it may be hung for a minute or two in a vessel of warm wine vinegar or in highly diluted sulphuric acid. All else having failed, the expert resorts to the knife, and removes one or more of the outer layers of the pearl until he finds one that is free from discolouration. Half-pearls, so much used in jewellery, present difficulties of their own in cleaning, because the layers are exposed at the base of the hemisphere. The coats are so unevenly affected by heat that this is not used. Acids or liquids of any kind may creep into the interior of the gem and cause unsightly spots. For half-pearls a paste made of precipitate of chalk and water is in favour. Chalk is used for the setting of jewels, to which it has a chemical likeness, and it is supposed to offset some of those losses that are gradually occurring.

Fixing Pearl to Glass in Glass-gilding.—The "Decorators' and Painters' Magazine" says: First gild the outline, and when quite finished fill the spaces between the lines with very clear varnish. When this becomes tacky, put a little size on the end of the finger, pick up some of the flakes of pearl, and put them on different parts of the letter. Fill in with smaller flakes, and lastly press on some pearl powder to cover the space completely. Apply the varnish with a soft hair-fitch, and to fix the pearl at the back, when the work is quite dry, press a layer of tinfoil well into the breaks. Paint over this with white-lead, tinted as may be required, and mixed stiff in boiled oil with enough japan gold-size to dry quickly.

Mother-of-Pearl.—Mother-of-pearl of moderate size may be obtained of dealers. It may be sliced with a circular saw, ground on an ordinary grindstone, then polished with Trent sand, of various degrees of fineness, on a revolving leather buff, and finished with lime or whiting. The slitting and grinding operations are conducted with the saw and stone running in troughs of water. It may also be incised with the graver, fret-sawn (with the addition of water to keep the saw cool), and shaped with a smooth file, but could hardly be cut with a knife.

Mother-of-Pearl Gloss on Gelatine Films.—This is produced, according to the patent of G. A. Poussole, Paris, by mixing an aqueous gelatine solution with ammonium bromide, the product obtained after drying being dipped into a silver nitrate solution. The gelatine is dried again, and again dipped, this time in a clear collodion solution; a final drying completes the process.

Mother-of Pearl, Iridescent.—The following process is said to be used in the Vienna shell-button works. In a wide-mouth jar fitted with a ground-glass stopper put as much ammonia water as will cover the shells. To this add silver chloride in powder until the liquid is saturated and there is a slight excess of the silver salt. Into this put the shell and, applying the stopper, set aside in a dark place for a few days. At the end of a week, more or less according to the heat of the weather, density and porosity of the shell, etc., remove the shell and place it, without washing, in direct sunlight for two or three days. The play of colours is usually established in a few hours, but its permanency is made surer by a little longer exposure. As a general rule, one week's contact with the ammonia water, with two days' exposure to the direct light, are all-sufficient.

Pearl-inlaying on Metal.—"Pearl-inlaying" is the name given to a process by which pieces of pearl are attached to the surfaces of metal and sometimes of papier-mâché. Mother of-pearl, known also as pearl oyster and white pearl, is chiefly used for the purpose. It has a clear white surface covered with minute grooves which decompose and reflect the light, imparting a number of beautiful tints. Aurora shell is used; this has a wrinkled appearance and is known also by its various colours. It is made from the shell of the mollusc known as the sea-ear or ear-shell. Another pearl used for he purpose comes from the green snail shell; this is distinguished by its glistening shades of green, yellow, and pink, blended together. In preparing the pearl for inlaying, the rough shells are cut with fine saws, the pieces being then ground on both sides on a grindstone until of the requisite thickness. With a pair of ordinary scissors the pearl is now cut into the form of leaves,

flowers, etc., or when many pieces of the same size and shape are required, a die press operated by foot power may be employed. Another method by which a number of similar pieces may be obtained consists in cementing the several thicknesses together and, holding the composite lump in a vice, shaping with a fine saw. Files and drills also assist in the shaping. If the cement employed is glue, soaking in water will separate the pieces, from which the glue can then be washed. To prepare the iron or other material to receive the pearl, it should be well cleaned and then coated with lampblack worked up with varnish. When this is thoroughly dry, a coat of black japan is applied, and when this is tacky the pieces of pearl are pressed on with the finger. Being left two or three hours in a hot oven, the japan dries, and then the whole is varnished and again stoved, this process being repeated several times. The varnish should be applied thickly, so as to bring up the surrounding surface to the level of the pearl; the varnish is scraped off the latter with a knife when the stoving operations are finished. The pearl is then polished with pumice-stone and water, and the varnish is rubbed smooth with very fine pumice powder moistened with water. The article now has the appearance of being inlaid, if the film of varnish applied is sufficiently thick. It is obvious that the whole process is not one of real inlaying. The next stages of the work can be successfully carried out only by a person possessed of an eye for the artistic. The pieces of pearl are made to assume the forms of flowers, etc., their stems and leaves being sketched in with a camel-hair pencil dipped in gold-size or in a mixture of varnish and turpentine. When tacky, gold-leaf is applied, superfluous gold being rubbed off with a piece of silk when the size or varnish is dry. The flowers and leaves are further touched up with paint, and the job is finished by coating with the very best varnish.

"Pearl Solder."—This is the misleading name applied to a very fusible solder employed for repairing articles containing pearls and other gems, when it is inconvenient to remove these. The colour of pearls is easily destroyed by the heat essential to hard soldering, and so a special solder of low fusibility is necessary. Such a solder may be prepared as follows: Bismuth, 1 dwt. (·050 part); lead, 15 gr. (·031 part); tin, 9 gr. (·019 part). This solder melts at about the boiling point of water, and is useful for many intricate little jobs. The flux used is Venice turpentine, which does not leave a stain on the finished work if the heating is done with care.

Polishing Pearl Shells.—If the shells are in a rough state, they are freed from the rough skin by means of hydrochloric acid. As this readily dissolves the shells, care must be exercised lest it eats holes through them. Deep scratches can be removed and a level surface gained by means of a scraper, file, emery cloth, or emery powder. If large quantities of shells are to be polished, a lathe or spindle carrying bobs of cloth will be required; these carry the shells through various stages, grinding the surface level with emery, smoothing with rottenstone or charcoal, and finally polishing on buff leather with whiting or chalk. The various substances are moistened or made into a paste with vinegar or dilute sulphuric acid; hot water or oil of any kind must not be used. If only a few shells are to be polished and no mechanical appliance is at hand, cloth may be folded into a firm pad, or may be tightly stretched over blocks of wood or cork for each grade of polishing powder, the final lustre being brought up by precipitated chalk and the palm of the hand.

Setting Pearls (*see* Jewellery).

Pebbles

Cutting and Polishing Pebbles.—Pebbles may be cut and polished by an amateur with the requisite patience, an old sewing machine serving as the basis of a cutting machine; but in place of the ordinary wheel it would be necessary to put a heavy fly-wheel, say of about 20 lb. weight and about 10 in. in diameter, with a pulley about 6 in. in diameter attached. On the table should be screwed two wooden blocks with bearings for a 1-in. iron pipe,

to which should be attached a pulley about 1 in. in diameter, and two nuts for bolting on the cutting and polishing discs. The cutting or slitting discs should be of thick copper about 4 in. in diameter, bevelled at the edges, and fed with emery and water. The polishing discs will be one of copper (about 6 in. in diameter) covered with fine sand and water, one of wood covered with crocus and water, one of wood covered with leather and whiting, and one of wood covered with felt and dry putty powder. Or, instead of the above, the slitting disc may be a thin disc of soft iron fastened to a spindle and driven with a strap off the driving wheel, much as a lathe is driven, excepting that the slitter lies parallel to the bed. The edge of the slitter is prepared for cutting by applying to it diamond dust or fine emery moistened with brick oil. For soft stones such as agates, etc., emery will be sufficient, but for harder gems diamond dust will be required. For polishing, a lead lap may be employed. This is made to revolve like the slitter. Two or three laps for different grades of emery and putty powder will possibly be required. Each lap, of course, must be kept for the same grade or fineness of grinding material. A final polish can be given by rubbing on water-of-Ayr stone.

Drilling Pebbles.—Pebbles can be drilled by the aid of a lathe, the materials being an iron wire and emery and oil, or soapsuds. Quicker drilling is obtained by using diamond dust instead of emery. The iron wire should be soft, so that the grinding material can bed into it.

Distinguishing Pebble from Glass Spectacle Lenses.—If the tip of the tongue be placed on a piece of glass it will feel rather warm and smooth, or woolly; but if the tongue be placed on a piece of quartz it will be cold, with a peculiar crisp feeling. Another test is hardness; a crystal of quartz will readily scratch glass, but the crystal will run over a pebble without leaving any scratch. A natural stone is a much better conductor of heat than any glass, and so to the tongue will feel cold; and being a variety of quartz, it will not be scratched by another crystal of quartz. If the pebble is supposed to be, say, a topaz or a ruby, then, being harder than quartz, it will in its turn scratch quartz. If the pebble is a diamond, then it will scratch a ruby or sapphire. Another rough-and-ready method of testing hardness is to pass a small fine-cut file over the edge of a bit of glass: there will be a somewhat dull, cutting sound emitted. If the file be passed over a bit of quartz the sound will be clearer and sharper. The above are at the best, however, rather rough tests, and the temperature test may not always be reliable. The only positive and scientific method of testing pebble is by means of polarised light. Most opticians use two plates of tourmaline, mounted in such a manner that their axes can be placed at right angles to each other, in which position light will not pass through unless a piece of pebble or other semi-axial crystal is placed between them. This instrument is termed the Tourmaline-pincette or pebble tester, and is sold by all wholesale opticians for a few shillings.

Pen

Drawing Pens (*see* Drawing Pens).

Fountain Pens (*see* Fountain Pens).

Pen which Writes with Water.—Make any aniline dye into a paste with gum water, and place a small piece of the mixture upon the inside of the pen-nib high up, and let it dry on. When the pen is dipped into water the dye is dissolved.

Perambulator (*see* Mailcart)

Petrol

Petrol is a distillation of crude petroleum obtained between 70° and 120° C., and its density or specific gravity varies from 0·690 to 0·735. It is practically synonymous with gasoline, and its chief employment is as a fuel for the internal-combustion motors of automobiles.

Petrol Stoves.—Petrol spirit (gasoline) stoves are largely used in America, and many of them are in use in Great Britain. H. B. Davis, the State Fire Marshal of Ohio, is responsible for the following "Dont's," which are largely applicable to petrol-gas lamps, etc., as well as to stoves:—Don't fill the stove's reservoir while the burner is alight; vapour of petrol is heavier than

air and will reach the flame, and the flash will so frighten the filler that more petrol will be spilled and the room instantly filled with flame. Don't fill the cap quite full, for petrol expands much more than water when it becomes warm, and is likely to force open a seam in the reservoir. Don't fail to shut off the burner before filling the reservoir, for the fluid leaking through it will make a vapour which will set on fire anyone striking a match to light the stove. Don't allow too much fluid to flow into the burner. Don't fail to close the burner tight when putting the fire out. Don't pour petrol from one vessel to another in a room in which there is a naked light, because the invisible vapour of petrol will be drawn to any near-by fire, lamp, candle, or gas jet. Don't fail to watch closely for leaks in reservoir or burner, because petrol, being but two-thirds as dense as water, will exude through a smaller hole. Remember, too, that when the leak is small there is no drop or damp spot anywhere to show its existence, because the petrol vaporises as fast as it exudes. Don't slop the petrol about—it is more dangerous than gunpowder; three-fourths of the accidents occur while filling the reservoir. Don't keep petrol in any jug or in a can larger than 2 gallons, because then it is difficult to pour out the liquid without spilling it. Don't mix the petrol and paraffin cans; that error has cost lives. Don't leave any petrol can open, because currents of air draw out the vapour. Don't use a petrol stove unless the bottom and three sides are closed to prevent combustible material from reaching the flame, and unless the main burner grates are 2 ft. from the floor. Finally, don't hunt the source of an odour of petrol with a light; the result of finding it is always instantaneous and disastrous.

Petroleum

Paraffin (*see* Paraffin).

Petroleum Ether (*see* Naphtha).

Petroleum Jelly.—Petroleum jelly may be made by melting 1 part of paraffin wax in a pan, and stirring in (till nearly cold) 5 parts of a heavy mineral lubricating oil. Ordinary petroleum jelly is made from yellow wax and oil; for a white kind us white wax and a pale-coloured oil.

Solidified Petroleum.—In the processe for preparing the so-called solidified petro leum, the petroleum is not really solidified but is emulsified or disseminated throug a solid or semi-solid mass. Among th many methods proposed are those in whic a lime soap of a fatty or resin oil is formed and then petroleum oil added to form a gela tinous or solid mass. The following ma be taken as examples: (1) 25 parts of linseed oil and 25 parts of earth-nut oil are heated in a boiler, 6 parts of quicklime and a little water are added, and the boiling con tinued till the mass is nearly solid, whe 50 to 100 parts of petroleum oil are added gradually and thoroughly incorporated by stirring. (2) Petroleum oil, 15 parts, and slaked lime, 2 parts, are thoroughly mixed and passed through a sieve to remove lumps; 3 parts of resin oil are then stirred in, and the whole heated and agitated till it is of the consistency of butter.

Pewter

Pewter is a greyish-silvery alloy of tin and lead, though other metals may be added or may replace the lead. A greater quantity than 20 per cent. of lead gives a bluish colour to the alloy, which is hardened by the addition of antimony. Whilst the metals are being melted together, the contents of the crucible are stirred with a strip of tin and zinc alloy, or a lump of zinc is placed on the surface of the molten metal. This "cleanses" the alloy; that is, prevents the formation of dross. The table below gives the proportions and ingredients of the principal pewter alloys :—

Name or Class of Pewter	*Antimony*	*Bismuth*	*Copper*	*Lead*	*Tin*	*Zinc*
Ordinary		—	—	18	82	—
Better ...	7	—	4·5	—	88·5	—
ditto ...	7	—	2	..	89	—
ditto ..		—	8·25	11	78	2·25
Superior	14·5	—	—	—	85·5	—
Hard ...	7·55	—	1·88	—	90·57	—
Aiken's ...	7·14	—	3·57	—	89·29	—
Plate ...	6·9	3·45	3·45	—	86·2	—
ditto ...	7	2	2	—	89	—
Trifle ...	17	—	—	—	83	—
Ley ...	—	—	—	20	80	—

Pewter is chiefly worked by hammering, or the metal is melted and cast into moulds, the article being afterwards finished in the lathe if its shape admits of such treatment. It is also "spun" in th l the.

Cleaning Pewter Pots.—Immerse the pots for two or three hours in hot soda-water to remove the dirt; then scour them to render them bright. Pewter can be polished with any ordinary metal polish.

Pharaoh's Serpents (*see* Python Eggs)

Phonograph (*see* Graphophone)

Phosphor Tin (*see* Tin)

Phosphorus

Phosphorus is a non-metallic element. There are two forms of phosphorus, the white and the red; they have the same composition, but different properties, and the one can be converted into the other by suitable means. The white phosphorus must be kept under water, as when dry it inflames spontaneously in the air; the red phosphorus is more stable, and will not burn unless a light or friction is applied. The red phosphorus is used in the composition for tipping matches. Phosphorus is very poisonous, and also dange ous, owing to its inflammability. Combinations of phosphorus—for instance, phosphates and hypophosphites of soda, potash, lime, and iron—are, however, of great medicinal value, being used as nerve-tonics. The phosphates of lime and potash are also essential to both plant and animal life, phosphate of potash being contained in seeds, and phosphate of lime constituting the greater part of the bones of animals.

Dissolving Phosphorus.—Phosphorus may be dissolved in carbon bisulphide, but the application of such a solution as paint might be attended with serious results, because, on evaporation in the air, the material often spontaneously ignites. To get a luminous effect it would be safer to use an ordinary luminous paint made from calcium sulphide.

Yellow Stick Phosphorus.—This is translucent, yellowish-white in colour, of a waxy consistency, and cylindrical in shape, being about 11 in. long and $\frac{9}{16}$ in. in diameter. The phosphorus comes from the manufacturer in sealed tin cans, each containing about fifty sticks immersed in water.

Picric Acid (*see* Acid)

Picture Frames

Corner Pads for Picture Frames.—Ornamental corner pads are moulded to desired pattern in wooden moulds, similar to a butter print. The pattern is drawn in outline on the wooden block (end wood), and is sunk to desired relief and all details of veining, etc., wrought with suitable carving tools. Then, the making of the pads, or corner pieces, which are really ornamental, s simple. The plastic compo. (*see* paragraph on p. 11) is simply impressed in the mould and stuck in position on the picture frame, th n set aside to harden preparatory to gilding. Another method—hardly so practical—is to use gesso (*see* that main heading and also the paragraph already ref rred t). This could be laid on with a small brush, and gilt in the usual manner.

Green Stain for Picture Frames.—Aniline dyes as so'd at most druggists' will do if mixed with plenty of hot vinegar. G een and blue yield a useful tone. Or apply hot, 2 oz. of verdigris, ½ oz. of China blue, and 1 pt. of vinegar; several coats will be required. These water stains have a tendency to raise the grain. The subsequent cutting down with glasspaper will give the white flecks often seen on frames. If this is objected to, colour must be used in the polish or va nish. Another simple plan would be to use emerald and bronze green mixed in hot beer.

Inserting Glass in Picture Frames.—When putting glass in picture frames, etc., in cold weather, make a good allowance for expansion all round, and be certain that the glass does not bind in the rebate owing to inaccurate cutting; otherwise there is a big risk of the glass cracking when the room gets warm. Careless nailing or sprigging at the back may also prevent expansion of the glass, with the same result.

Mitering Compo. or Gilt Frame .—There is usually some difficulty in dressing mitres of compo. or gilt frames when a straight-gabbed plane is used. Such mitres should

be finished with right and left skew-gabbed planes. The plane iron, being on the skew, is always in advance at the top of the cut, and, cutting diagonally downwards through the gilt face of the moulding, materially tends to prevent chattering the friable surface.

Nailing Picture Frames.—A usual method of nailing picture frames is as shown in Fig. 491. The faces of the mitres being glued, the loose side is placed against the fixed one so that the slip during the driving home of the nails brings the mitres true. When cramps are used the glue may be allowed to dry before the corners are nailed,

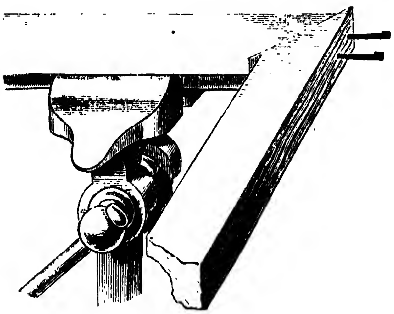


Fig. 491.—Nailing Picture Frames.

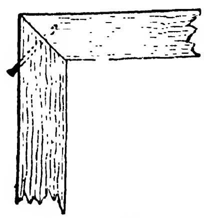


Fig. 493. Securing Mitered Corner of Gilt Slip.

so that the slipping tendency is obviated. A professional has made up frames for the trade, some of them as wide as 6 in., with no other boring tool than a pattern-maker's bradawl. When boring for nails, he places the hole as near the front of the moulding as possible, and always bores with the face towards him, keeping the bradawl perfectly upright, as shown in Fig. 492. He does not allow the glue (which must be thin and strong) to go farther than the dotted line, thus preventing the glue from squeezing out on the face of the stuff and spoiling the appearance of the work.

Picture Frame Compo.—A recipe for "compo" is as follows: 1 lb. resin and 1 pt. raw linseed oil melted together. Boil 2 lb. of glue in $1\frac{1}{3}$ pt. of water, and when all are dissolved, put the glue in with the resin and oil, and while it simmers, slowly stir in powdered whiting till of the consistency of dough. This is used warm, and can be fashioned with the finger and wooden or metal modelling tools. Gesso paste, also used for frame ornaments, is very similar: mix to a stiff paste a teacupful of whiting with water, stir in half a cupful of liquid glue (rather thin), add half a cupful of resin varnish (resin dissolved in oil), and add also a few drops of carbolic acid. The gesso should be used hot, and should be just thick enough to drop slowly from the camel-hair brush. Higher relief is obtained by successive layers of gesso paste, which should be laid on before the preceding coat has quite set. The petals and leaves are

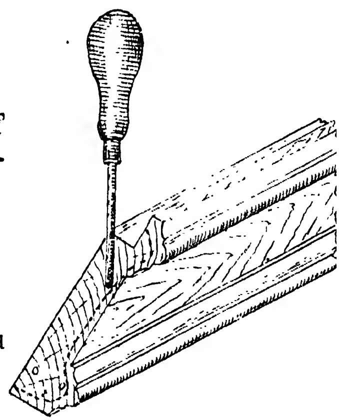


Fig. 492.—Boring Nail Hole in Picture Moulding.

modelled to shape and then prepared for gilding.

Picture Frame Making.—In making picture frames keep the glue as hot as possible, but not too thick. An experienced worker says that the use of corner cramps is only a waste of time, but each worker will decide this for himself. After having shot the mitres true, place the longest length in the vice (a parallel vice is the best, as it is low on the bench, and the end of the mould farthest from the vice can be rested on a block, which is a great help when nailing up). Then take one short side in the left hand, bore the nail hole, place on the glue, and put the mitres together flush on the face, with the short

piece (the one with the nail in) about ⅛ in. back to allow for driving. Then drive in the nail, and the result should be a perfect fit. If not, look to the mitre shoot, for there the fault will be found. If the mitre is open on the inside or outside, adjust the mitre shoot till it makes a perfect mitre. Above all, keep the plane irons sharp.

Polishing Oak Picture Mouldings.—Systematic handling in quantities is the chief factor in gaining a level bright surface. The grain filler may be one of the patent wood-grain fillers, or plaster-of-Paris may be used. If a dark colour is desired, the filler is tinted by the addition of burnt brown umber; if a light colour is wanted, yellow ochre is added. A light or dark colour polish may be used. Polish prepared with bleached (white) shellac is suitable for frames of which the light wood is to show. The plaster-of-Paris filling may be simply mixed with water or, as is generally the case, with Russian tallow kept hot whilst in use. If only a few lengths are to be treated, the whiting and turps filler generally used by french polishers will do. Whatever is used must be well rubbed in, and the surface of the wood left quite clean. Then place several lengths of moulding on the bench and well body in, using an old polish rubber without rag covering. Should the grain have a tendency to rise, use pumice powder freely; this serves the double purpose of grinding the polish level and filling the grain. Use glasspaper as little as possible. Having got an even body of polish on all the lengths, apply a coat of spirit varnish, and set the mouldings aside to harden, meanwhile bodying-up and varnishing another batch. Then returning to those first taken in hand, start to polish again, this time with a rag covering to the rubber to prevent the work becoming linty. Keep this rubber soft, pliable, and always moist, so that it will readily adapt itself to the whole of the surface. Having levelled the varnish, using pumice as required, and having filled up any apparent open grain, apply another coat of varnish, and set aside till next day. On taking up the work again, it will be found that as the spirit has evaporated and the wood absorbed the polish and varnish, the grain is still open to some extent, and some mouldings will require more polish than others. Body-up again, still using a covering to the rubber, until all the lengths appear to have an even body of polish. The brightness is then generally brought up by glaze. This can be bought ready made, and as it gives best results if kept in stock for some months, this course is advised. It can be made by dissolving 8 oz. of gum benzoin in 1 pt. of methylated spirit. Some practice is required to gain proficiency in using glaze, which is applied by means of a pad of wadding or velvet always in a straight direction, and in a room fairly hot and free from draughts. Varnish may be used as a finishing coat if glaze is objected to, but it should be first carefully strained, and used rather thin. Also, if possible, apply it by a brush that will spread over the whole width of the mouldings to avoid passing over any portion several times.

Securing Gilt Slips in Picture Frames.—The gilt slips used in picture frames are mitered together in the usual manner; they are then laid flat on a thick board or bench, the latter being perfectly flat and true on the face. One piece is held secure by means of a hand-screw; the return piece is brought to the mitre, a fine hole made with a bradawl, and a pin inserted and driven home (*see* Fig. 493). The frame is moved round, and each mitre is secured in a similar manner until all the mitres are fixed. Glue is sometimes used. When using the hand-screw it is advisable to place between it and the gilt slip a piece of felt or cloth to prevent injury. A quicker way of securing gilt slips to picture frames than that recommended above is first to cut the two shortest slips to fit in the frame, and the other two just long enough to spring into their places. By springing them in thus, they hold together without gluing or nailing. Fitting them after the glass has been put in makes a better finish.

Picture Hanging

Dry walls are essential to the preservation of pictures, and contact with any wall

may be prevented by screwing the metal eyes or rings a few inches down the sides of the frame at the back, thereby giving the picture, when hung, a sloping position towards the spectator (*see* Figs. 494 and 495), and by gluing cork or leather pads at the bottom corners. This also allows the air to circulate freely round the frame. Oil paintings should not be hung where they are exposed to the full glare of a hot sun, or they will be cracked and blistered. A glazed picture should not be hung immediately opposite a window, as the strong light falling directly upon it causes all objects in front to be reflected in the glass, to the utter obliteration of the picture; at the same time a good light is necessary both for preserving and seeing pictures. Appliances for hanging pictures are various, the most common being the ordinary brass-headed nail and cord, but an advance upon this is the picture nail and wire or cord. The ordinary picture nail is shown in Fig. 496; these nails are provided with adjustable ornamental heads of various designs in metal; many have centres of either glass or china, or both; the head has a thread sunk in the centre at the back, and a corresponding thread is worked on the thick end of the nail or spike. Before driving, this head is unscrewed, and care must be taken that the thread is not injured on the spike when using the hammer. When firm, the head can be screwed on again. Drill a small hole in the brickwork and insert a small wooden plug, if a suitable joint cannot be found, and drive the nail into this (*see* Plugging Walls). Another kind of picture nail that is sometimes used somewhat resembles a sleeve-link in its action; a tube at the back of the head slides over the thick end of the nail, and a snap arrangement joins the two together. When a picture is to be suspended from one of these nails, a joint in the brickwork should be found at the proposed position by means of a long, thin bradawl; this reduces injury to the plaster to a minimum. If the picture is heavy the strain on the cord may be relieved by driving a nail in the centre at the bottom of the frame. Figs. 494 and 495 are back and side elevation of a picture so hung. When cord is used, linen cord is preferable to worsted-covered cord, as the latter is not so strong, and is liable to fray and look unsightly. The knot should not be tied to the rings, but between them; it is then concealed behind the frame when the picture is hung. The advantage of screwing the rings or eyes that support a frame of any weight, down each side at the back is obvious; if screwed into the top portion of the mould the top mitres have to bear the whole weight and will be liable to give, whereas by the method advocated the entire weight will be thrown on to the rings, which should have it. There are numerous patents in the market for lengthening and shortening the cord to raise or lower a picture for adjustment. A better and more elaborate method of hanging pictures is by means of rods and hooks (*see* Figs. 497 to 500). These rods are hollow metal tubes that are supported by brackets about every 2 ft. all round the room; they are generally fixed just below the ceiling cornice, and at each angle end in a knob or spike. On these rods the hooks are threaded previous to screwing on one of the ends, and over these hooks the cord, wire, or chain of the picture passes. The terminal knobs or spikes are secured to the ends of the rods by means of an iron screw projecting from the centre of the neck; this engages with tapped holes formed in or attached to the ends of the tubes; or the ends of the rods are plugged with wood, and the terminals screwed into these. Occasionally the screw-threaded pin is attached to the ends of the tube, and the terminal knobs are screwed on these like the finial knobs on to an iron bedstead. Sometimes a projecting member of a ceiling cornice is used to suspend pictures. A moulded false cornice, with projecting bead, is also frequently made use of; this is known as a picture rail, Figs. 501 and 502 showing a section and elevation of it. The hook in this case is of S shape or a double hook of cast metal; the upper curve is larger than the lower one, to enable it to fit on the bead. There are many varieties of these hooks, all claiming precedence in security of grip on the mould or cornice. In public galleries pliable vertical metal strips are often used; these are screwed

to the bottom of the frame at the back, and are laced through horizontal strips across the back. Holes in the top of the vertical strips pass over the nails, or are hooked so as to clip horizontal iron fillets fastened to the wall.

the frieze (if the room has to be papered) must be ascertained; or, if the room is already papered, the moulding must be kept a suitable distance from the ceiling to allow of a frieze or border being added, if wanted, in the future. For a room with

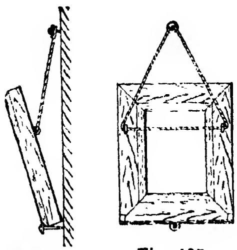


Fig. 494. Fig. 495.

Figs. 494 and 495.—Picture Hung on the Slant.

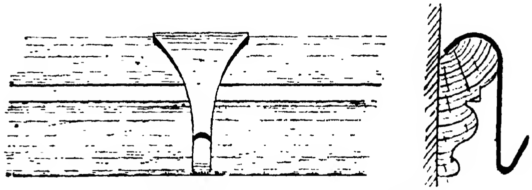


Fig. 501. Fig. 502.

Figs. 501 and 502.—Picture Rail and Hook.

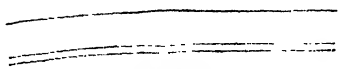


Fig. 504.

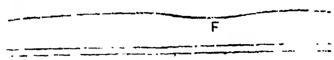


Fig. 505.

Figs. 504 and 505.—Ceiling Curves and Picture Rails.

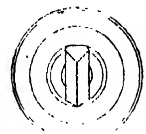


Fig. 500.—Front View of Rod Bracket.

Fig. 497.

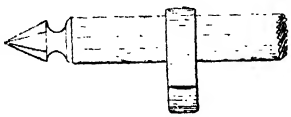


Fig. 498.

Figs. 497 and 498.—Picture Rod and Hook.

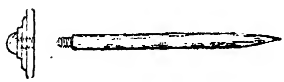


Fig. 496. Picture Nail.

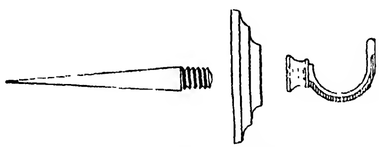


Fig. 499.—Rod Bracket.

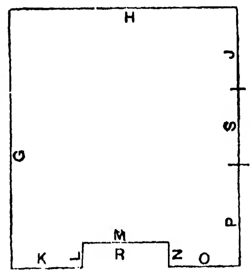


Fig. 506.—Room Plan, showing where to Fix Rail.

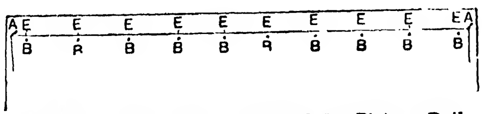


Fig. 503.—Side of Room Plugged for Picture Rail.

Picture Rail Fixing.—Suitable dimensions of picture rail moulding for ordinary sized rooms are 1½ in. by 1 in. The rail can be had in plain wood, for painting after fixing, or already tinted with enamel or gilt. These latter kinds have the advantage of being finished as soon as fixed, but they require far more careful work when fixing, as the surface chips very easily. Before beginning to fix a picture rail, the depth of a cornice round, from 6 in. to 9 in. will be about right; otherwise 10 in. or 12 in. will not be too deep for rooms from 8 ft. to 10 ft. high. Having decided on the position of the moulding, near each corner of the room on one of the longer sides drive in a nail, and stretch a line tightly from nail to nail, so that the line shows the position of the top of the moulding, and proceed to drill holes for plugs about 1 in. below

the line at intervals of about 18 in., the end holes being about a foot from the corners. (Instruction on drilling holes in walls is given under the main heading, "Plugging Walls.") Fig. 503 shows the side of the room with the holes drilled, A being the two nails holding the line, and B the plug holes. The holes are made an inch below the line; the most suitable part of the moulding through which to drive the nails is the square part. Drive one plug into each hole, cutting off any part that projects beyond the surface of the wall, and over the centre of each plug make a pencil mark, as shown at E (Fig. 503). The same procedure can be followed at each of the four sides of the room, all the plugs being put in before any moulding is fixed. When drilling the holes for plugs, notice if the ceiling or cornice is straight or otherwise; if straight, follow the line as near as possible, but if not, some allowance must be made. The ceiling may be as shown in Fig. 504, round or hollow from corner to corner; in this case the moulding should be made to follow the curve to a certain extent, taking care not to overdo it, and the plugs must be put in accordingly. On the other hand, the ceiling may have a series of curves, as shown in Fig. 505; in such a case, take the measurements from the lowest points, as at F, and put the moulding straight, as shown. In fixing the moulding, it is important first to consider where to begin. Fig. 506 shows a plan of an ordinary room, with the chimney breast at R and the window at S. The doors are not shown, as the moulding will run over them, and their positions will not affect it in the least. The first length to fix is that marked G; this must be nailed up as it is, no mitres being wanted at either end. But if the room is a fairly large one, the length may require splicing. If so, cut a mitre on one end, so that a nail can be driven through it into a plug; then on another piece of moulding cut the mitre the reverse way, when it will fit the first one exactly, and can be nailed at the joint to the same plug. The next length to fix is that marked H. Cut off the moulding so that it will fit just easily between the two walls at the side of the room. Then at the end which has to fit to the length G, with a sharp chisel and gouge remove whatever may be necessary to fit the front face of G. This is called "scribing," and if the wood is cut away carefully, this length will fit closely on G, when it must be nailed to the plugs. The length J is fitted in the same way. First cut it off the right length to fit easily between the wall and the window architrave, then scribe it to H as above, and fix. The length K must be fixed next, scribing it to G and letting it fit closely to the chimney breast. L must first be scribed to fit K, and then held in position and marked at the back for the length. The connection between L and M must be a mitered joint, the mark above mentioned being the short side of the mitre; the latter must be cut by the saw from the side opposite to that at the ends cut for scribing. The mitre should also be cut a trifle longer than the mark, as the chimney breast, as a rule, drops off at the ends. After fixing L, fit the corresponding end of M to it, and also mark the length and cut the mitre in the same way as before; fix M, and fit and fix N to it. These three pieces, L, M, and N, should all be cut consecutively for the same length of moulding to ensure the correct intersection at the mitres. The remaining two pieces, O and P, will only require scribing and fixing in the order named, and the job is done.

Pictures (*see also* Prints)

Bruises or Dents in Oil Painting.—If the injury is a dent in the canvas, the picture should be taken from its frame and carefully dusted both front and back. A sheet of clean paper should then be spread on the table and the picture placed on this face downwards. Another piece of paper should then be spread on the back of the picture and the bruise smoothed down with a warm flat-iron, but not so hot as to endanger the colours or varnish. Afterwards the picture should be left under pressure for two or three days. Some workers, however, think that it is safer to roll the bulge flat with a common black bottle filled with hot water than to use the iron. Should the canvas be actually burst, it may be

necessary after smoothing to put a patch of new canvas on the back. If so, the space to be covered should be sprinkled with powdered shellac, and the patch ironed with a flat-iron warm enough to melt the shellac; this will cause the patch to adhere. Afterwards, pressure should be applied as before. Should the warmth used have caused any paper, etc., to stick to the front, it can be removed by means of a soft sponge merely damped.

Cleaning Oil Painting.—An old oil-painted picture, heavily varnished, and long exposed to dirt and smoke, can be cleaned in the following way. Mix two-thirds rectified spirit of wine and one-third spirit of turpentine. Remove the painting from its frame and place it flat, face upward. Moisten a small wad of clean cotton-wool with the mixture (which must be kept well stirred up), and rub it gently with a circular motion over a small piece of the picture. Begin at some unimportant part, so as to ascertain how much rubbing the picture will bear, before venturing on the face and finer parts. Take great care in rubbing not to disturb the colour as well as the varnish and dirt. Look now and then at the cotton-wool to make sure there is no colour on it, and often change the wad for a clean one. When the varnish and dirt have been rubbed up, wash the work with a clean wad and clean turps, or with a soft sponge and clean rain-water. Carry on these processes over the whole picture. The greatest care is required when rubbing, and more so when working over the shadows than when over the lights. Re-varnishing, when the picture has had time to dry, must be done very lightly. A mastic varnish is commonly used. The following plan has been recommended:—Mix (say in a jam-pot) two-thirds mastic varnish and one-third turps, and set in a bowl of boiling water. Stir till a vapour rises, then give the picture a thin coat of the mixture; this, after due intervals, can be repeated once or twice if necessary.

Cleaning Picture Mounts.—There is no particular method of cleaning mounts except by using bread-crumbs or soft indiarubber. The most satisfactory way, where possible, is to have the picture re-mounted entirely.

A picture that is merely incrusted with dust may be cleaned by laying over it a damp cloth for an hour or so and repeating the process, using a clean cloth every time till all the dirt has been soaked out. The picture may then be treated with a thin coat of mastic varnish. If the picture is old and valuable, and it is desired to remove the varnish, those in the trade do so by continual rubbing with the fingers, taking off the varnish in little crumbs. But this is a very long and tedious operation. Turpentine, a weak solution of ammonia or alcohol, or methylated spirit may be used to soften the varnish, which is then carefully rubbed off. Great care is necessary when using these solvents to prevent them attacking the paint. Have some water at hand, and apply immediately the paint seems affected.

Cleaning Unvarnished Pictures.—In cleaning unvarnished pictures discoloured by the smoke of fireplaces, lamps, tobacco, steam, dust, flies, etc., no solvent must be used. Wipe off as much dirt as possible by means of a damp chamois leather, a little whiting on the leather being of great assistance. If the discolouration is very great a mixture of finely powdered Bath brick and pumice powder in equal proportions may be applied with the damp leather, or the whiting, Bath brick, and pumice may be used in combination. Great caution is necessary with this friction method, as it is more dangerous than any other. The canvas surface, on examination, will be found to consist of a series of elevations and depressions, and when paint is applied it sinks into the lower portions, leaving a thinner coat on the higher parts. Friction, therefore, naturally takes the paint off these raised parts, leaving the threads bare. Again, in pictures painted on panels the grain becomes more prominent with age, and will be left bare unless carefully watched. In these two instances the restoring by colour would be very tedious. Pictures that have dried into the canvas should, after being carefully gone over with the damp leather, be freshened up with boiled linseed oil, carefully wiping all off again and polishing the surface with a clean soft silk duster.

Cracks in Oil Paintings.—Cracks are most likely caused through the use of too much "medium" in painting; they might arise, however, from several other causes, such as varnishing before the work was thoroughly dry, or the placing of quick driers over slow ones before the former had become hard. Hanging the picture in a very dry or hot room will tend to increase the evil. There is no complete remedy.

Creases in Pictures.—Pictures that have been creased by folding may be effectually treated by either mounting the print on cardboard or by placing on a wooden frame. If the latter method is adopted, make a deal frame about 1 in. smaller than the picture each way, damp the latter thoroughly on the back, paste about half an inch of the back of the margin all round, and, having placed the picture on the stretcher, press down the edges so that they adhere to the sides of the frame. When dry, the print will be perfectly smooth; it may either be cut from the stretcher and framed, or framed and glazed without removing from its support; the course adopted must depend on the amount of rebate on the moulding.

Mounting Picture to Imitate Oil Painting.—Make a stout deal frame and stretch the front with unbleached calico, tacking the latter with tin-tacks, and taking care that all folds and wrinkles are pulled out. Now, turn the picture face downwards on a newspaper, and, having trimmed to the size of the stretcher, damp the back with water. The sponge should be passed over several times until all curl is removed. When the water has soaked in well, coat the back with strong paste; then drop the stretcher down and rub well with a dry cloth on the back of the canvas. The picture should be well rubbed down at the edges of the stretcher, as a good hold must be secured there. If the edges are inclined to curl, put the stretched work face down on a clean table and place weights on top. Best quality paper varnish is generally used for this work. Of course, previous to varnishing, the picture must be coated with size and allowed to dry.

Mounting Pictures to Prevent Curling.—For this purpose it is necessary to paste the back of the picture evenly all over, and when laid down upon the mount to rub it down with the hand and then with a flat stick or paper-knife, having interposed a sheet of clean paper. Place a board on top (keeping the paper in position), put weights on the board and leave for a few hours. Another method: If two strips of paper are pasted at the back of the mounts diagonally, from corner to corner (crossing in the middle), at the time the pictures are mounted, it will prevent them curling. Damping the backs of pictures that have curled will sometimes bring them flat again.

Oleograph.—The term oleograph is generally applied to pictures in oil colours, produced by a similar process to that of lithographic printing. Sizing and varnishing these pictures tends to preserve them, as they can be repeatedly cleaned when necessary, but they require to be carefully treated. The size used is of the clearest quality—gilder's parchment size is the best; a small quantity melted in double the amount of boiling water is sufficiently strong. A special varnish called "picture varnish" can be obtained, but copal or French oil varnish can be used.

Oleograph, Cleaning.—Lay the oleograph face downward on the table with a piece of clean muslin beneath. With a soft hat-brush go regularly over the back of the oleograph, taking the strokes one way only so as to avoid creases. Shake all dust from the muslin, lay the print on it back downward, and having cleaned the brush by rubbing it on a piece of clean muslin, repeat the brushing on the face. The surface can then be further cleaned with stale bread-crumbs worked about under a flat piece of wood.

Oleograph, Removing Mildew from.—There is always a difficulty in completely removing stains of any kind from paper. The mildew or yellow stain (which is really the ageing of the paper) may be removed by a solution of chloride of lime. Make this by placing a pennyworth of chloride of lime in a bottle and adding about ½ pt. of water. It will be best to apply this solution over the entire surface with a flat camel-hair brush while the picture is lying flat upon the table. If the stains

disappear it should be blotted off, and afterwards washed with water, using the brush in the same manner. It is not advisable to rub or apply the solution in patches. There are many other chemicals used for this purpose, but they have all the same effect, and the one given will produce as good a result as any of the others. If one application does not remove the stains, the process may be repeated, but if the stains are of long standing they will not be completely removed by any process. A much better method, and one taking less time, would be to cut away the white margins and mount the pictures on thin white cardboard. Paper varnish and paper size can be procured from any oilman. The pictures must be first sized and afterwards varnished. Two good flat brushes will be required. The size is used hot, and is put on with the brush, working quickly first from left to right and then up and down lightly, to make it as flat as possible. The picture is then hung up to dry; if laid out flat it will dry in pools. When it is dry it should be varnished. The varnish is applied in the same manner, but the movement of the brush must be slower, as the varnish is thicker and does not run so readily from the brush. Care must be taken to avoid streaks. The picture is now hung up to dry or laid out flat. Another method: The pictures must be taken out of the frames and tacked on a flat board near a fire. After they have dried for a time, wipe them very gently with a soft silk rag; if any of the varnish has been disturbed, it must be touched up with a camel-hair brush and best white paper varnish.

Oleograph, Removing Varnish from.—Unsatisfactory varnishing may suggest the removal of the varnish and the application of a new coat. If the varnish is thoroughly hard, the surface may be rubbed down with fine pumice powder; and then, in order to remove any scratches, rub down with whiting that has been sifted through muslin. Finally, wipe over the surface very lightly with a pad of cotton-wool wrapped in soft rag, and moistened with spirit of wine. In re-varnishing, the varnish should be thinned down to such an extent that a very thin coat can be given, and the coat can be repeated if necessary. Great care will be needed throughout the work.

Re-mounting Picture.—If the picture is simply glued on top of the mount, it could be left on as at present, placing over it a new cut-out bevel-edged mount, letting the bevel edge lap over the picture ⅛ in. all round. If, however, it is wished to remove the old mount, lay it on a wet surface, such as a large sheet of glass or a table top, and let the moisture soak through the mount till the glue or gum is softened, then insert a thin-bladed table knife between the picture and the mount, and very gently prise off the picture. By going very carefully and gradually all round the edges, there will be little fear of tearing the paper.

Pincers

Pincers are very useful tools for extracting and beheading nails. They are all of much the same shape, with variations in the handles. Lancashire pincers have a cone and claw at the ends of the handles, and Tower pincers have a ball and cone.

Pipeclay

Pipeclays are very fine pottery clays, rich in silica, and are found in Dorsetshire, Cornwall, and Devon. They are mixed to a plastic mass with water, moulded, and then burnt in a kiln. It is the burning which hardens the clay.

Bleaching Pipeclay.—Very likely it would be possible to bleach pipeclay by employing hydrochloric acid. Dilute 1 pt. of strong hydrochloric acid with 6 pt. of water; place it in an earthenware jar in a pan of water. Put the pan on to boil, and stir the pipeclay into the acid. After about an hour's heating, throw the pipeclay on to a filter-cloth and wash it well with water; then dry in the oven. At any rate, this treatment will improve the colour.

Hardening Pipeclay.—If mixed with water and then pressed, pipeclay will be hard enough for most purposes. To make it more like blacklead in feel and properties, mix it with soap water instead of water alone. For this purpose, boil 1 lb. of white curd or yellow bar soap with 1 gal. of water, and mix while it is warm.

Pipes

Cement for Pipe Joints.—Red-lead putty is commonly used for this purpose. A cement for pipe joints, said to be as good as and one-tenth the cost of red-lead putty, is made by mixing ordinary pine tar and dry oxide of iron. It does not dry so quickly as red-lead, but adheres well under pressure.

Lead Pipes, Tinning (*see* Tinning).

Leaky Pipes.—When a leak appears at a socket of a wrought-iron pipe, consider, first, whether it will "pick up," which means stop itself by rusting up; secondly, whether the leak can be caulked up with a chisel; thirdly (and most usually), whether by screwing up the length of pipe, or the socket, the leaks can be stopped without starting another one further back. This can always be done successfully if there is a connector or union conveniently situated. Lastly, it may be necessary to take out the length of pipe and socket and re-make the joint soundly. This latter is a last resource, as it entails emptying the apparatus, which the other methods do not. A leak in a wrought-iron fitting can be stopped by caulking the metal with a round-nose caulking iron, or if the break is relatively large a small piece of soft solder can be driven in; this latter method is also applicable to leaks in wrought-iron storage tanks. Temporarily to stop a leaky pipe, either of iron or of lead, a strip of india-rubber can be forced into the aperture, and held in position by clamps drawn together by bolts.

Lime Deposit in Pipes.—It would be possible for hot-water pipes to become so furred up with lime as to be unsafe, but whenever the lime deposits become thick enough to reduce the bore in the pipe to about ½ in. or ¼ in. (according to the power of the boiler), the noise produced becomes unbearable, with the result that a workman is called in to remedy the trouble. The noise always occurs, otherwise furred pipes would be a prolific source of danger. There is no fluid or composition that will do more than turn the incrusted lime deposit into a soft or loose state, ready to be cleaned off; this is sufficient in boilers, but pipes, tees, and connections would have to be made to admit of a scraping tool being inserted. If this provision can be carried out, there is no reason why the pipes should not be cleared periodically. The material used is generally tannate of soda, but many firms sell special compositions. However, there is, it is feared, no practical way of removing lime deposit from iron pipes, and with boilers all that can be done is to open them and chip out the lime with a chisel. It has been stated that making the pipes red-hot and hammering them will loosen the scale, but to do this they must be taken out, and in the end new clean pipes would cost no more. There are "boiler fluids" sold which, when boiled up in the boilers and pipes, soften the deposit, but do not remove it; it must be scraped out. The only practical recourse is to put new pipes in, and the larger they are the longer they will go without renewing.

Pipe Coverings.—The following is the method of coating steam and hot-water pipes with asbestos preparations. Mix the asbestos meal in a tub holding about half a bushel, and add water until the mixture is as thick as mortar. Having made the pipes to be covered about as warm as the naked hand can stand, take the mixture in both hands, rub the pipes over with it very thinly, and let it dry. Great care must be taken not to overheat the pipes when coating them, and the composition should be allowed to dry gradually. The next coat should be about 3 in. thick, and should be left as rough as possible by sticking the ends of the fingers into the surface when wet. The third coat should be added in about 2-ft. lengths, and should be finished off smooth with a small straightedge about 1 ft. long by 2 in. wide by ½ in. thick, having sharp edges slightly rounded off. The straightedge should be kept constantly damp when in use by dipping it in water. When the last coat is thoroughly dry, wash over with thin wheat-flour paste; and when again dry, paint or tar, as preferred. To stand very rough usage, canvas saturated with wheat-flour paste should be laid on prior to painting. The compositions used in Great Britain for covering steam-pipes and boilers are

mostly the subjects of patents, but it is not a difficult matter to devise something that will answer the purpose. Air confined round the source of heat is a very good non-conductor of heat, and any material that is full of air cells is a very good covering for steam-pipes. Hair-felt is an example of a good covering, because it is full of air cells, and if the felt is afterwards well wrapped up or plastered over with an impermeable outer skin, the result is still better. Hair-felt, of course, is not a composition, but the example serves to show the kind of covering that is wanted. The materials that figure in compositions are cork in coarse powder, chopped hair, hay, cocoanut fibre, sawdust, and other materials of a like nature that, when applied to the pipe, will retain a large quantity of imprisoned air. Fireclay, as well as ordinary clay, is used as the cementing material; a little plaster-of-Paris or Keene's cement is helpful, but Portland cement is not good. Only cheap and common substances need be used, and a thickness of 1 in. ought to be sufficient. It is advisable, before applying the bulk of the mixture, to rub some of it on the pipe and let it dry, so as to form a key. The composition should, as a rule, be applied when the pipe is hot.

Pipe Coverings: Care in Winter.—The wrapping-up of pipes for the winter should not be neglected. All pipes inside the house, and as many pipes outside as can be got at, should be covered. A good material is floor-felt cut up into strips about 2 in. wide, and wound round and round the pipes from where they spring out of the cistern to where they come through into the rooms below. Tie at intervals of about 6 in. with string, and finish up by winding round strips of strong brown paper tied as before. When there is a join, tie on each side of it to prevent the stuff from slipping, and make sure that the stuff is fast at the cistern end. Outside pipes, where they can be got at, should be treated to several coatings of thick brown paper put on with shellac, and fastened at intervals with fine wire. Three layers of brown paper are almost equal to one of felt if cemented on in this way, and if a final coat of paint is given the pipes will not look unsightly, and will be very unlikely to burst, even with a severe frost, for paper is a good heat-insulator.

Pipe Coverings: Use of Unslaked Lime.—For protecting water-pipes from freezing, the means generally employed is to use coatings, such as straw, cork, and oakum, which are non-conductors of heat. There are, however, more effective agents, also of use in thawing frozen pipes. The pipes are first covered with a thin layer of straw, sawdust, or tanbark. Pieces of unslaked lime as large as the fist are then packed around them, and enveloped in another layer of some non-conducting material, and the whole is held firmly together by means of a wrapping of coarse linen. The first layer is for the purpose of protecting the pipes from the action of the fresh lime, which would cause the metal to rust. The lime draws moisture from the air and the materials surrounding it, and is made warm by means of the chemical reaction. The outer covering allows only a small amount of atmospheric air to pass through, so that the lime becomes slaked only very slowly, thus keeping up the temperature during an entire winter. This method, with slight variations, can be applied to the thawing out of frozen pipes; somewhat more lime is packed round the pipes, and the water is poured over it; then the heat generated will melt the ice in the pipes. The ground in winter can also be thawed out in this way, when it is desired to lift paving stones without breaking them.

Preventing Frost-bursts of Water-pipes.—Water at the temperature of 39° on the Fahrenheit scale, or 4° on the Centigrade scale, is at what is called its "maximum density." By this term is meant that a volume of water at the above temperature occupies less space than it does at any other temperature; in other words, water in passing either above or below this point expands. In cooling down from 39° F. (maximum density) to 32° F. (freezing point), this expansion is equal to about one-ninth of the volume. Thus a body of water that at 39° F. measured 9 gal., will at 32° F. be equal to about 10 gal. The force exerted in this process of expansion is so great that a strong iron

bottle filled with water that was afterwards frozen has been burst into fragments. The bursting of water-pipes during frosty weather takes place during this expansion, and

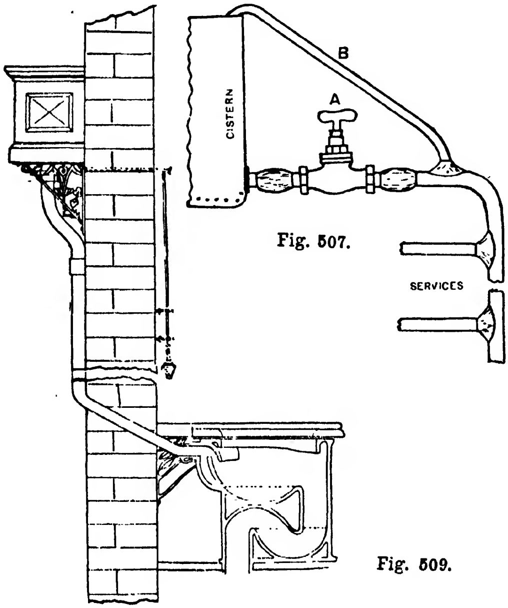


Fig. 507.

Fig. 509.

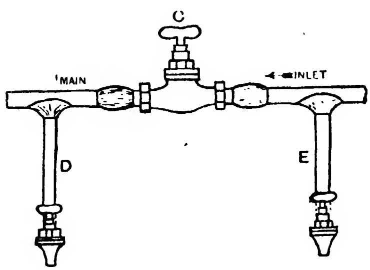


Fig. 508.

Figs. 507 and 508.—Arrangements for Shutting Off Water and Emptying Pipes.

Fig. 509.—W.C. Flushing Cistern fixed to Wall of Next Room.

not, as is often supposed, during the thaw. This popular error is due to the fact that, the water solidifying into ice at the moment the fracture takes place, the burst is generally not noticed until it is betrayed by the water spurting out when the thaw sets in. To illustrate what occurs, a glass bottle should be filled with water, securely corked, and placed out of doors during frosty weather. When the contents have been completely frozen, the bottle will be found to be fractured, and on examining the fracture it will be found that ice protrudes from it, clearly showing that the fracture took place when the water was in a liquid state. In like manner, ice can be seen projecting from burst pipes if they are examined before the thaw sets in: and water has even been known to run down the pipe a short distance before becoming solidified. There are several ways of guarding against frost-burst, and different methods have to be resorted to under the various conditions that arise in connection with the position of the pipes. The primary object in all cases, however, is to protect the pipes with good non-conducting materials, so that their temperature may not be lowered to freezing point. The materials used for this are many, hair-felt being perhaps the one that is mostly employed. It can be obtained in strips and sheets of various widths, which can be easily wound round the pipe. The only objection to the use of this material is that it is liable to harbour moth, etc. To obviate this, silicate cotton or slag-wool may be used. This also can be obtained in strips of convenient width. Sawdust (wood) is also often used, but the objection to it is that it has to be kept in position with casings. The cisterns should be protected by being fixed in a proper cistern room, well warmed, lighted, and ventilated, and not fixed close under the slates where the cold winds have easy access to them. They should also be cased in with slag-wool, and fitted with a dust-proof cover. The pipes inside the house should be fixed on an internal wall. Where, however, they are necessarily fixed on external walls, the pipes should be carried on a board, to prevent loss of heat by radiation. They should also be arranged so that the supply can be shut off at night, and the water drawn out, leaving them empty. How this can be arranged as regards the down services is shown in Fig. 507. A stopcock A should be first fixed as close to the cistern as possible, to shut off the supply of water. To empty the

services, an airpipe must be fixed as shown at B, allowing atmospheric pressure to be exerted on their contents. If this airpipe is not fixed, it will be impossible to empty the pipes. To empty the rising main, an arrangement as shown at Fig. 508 may be adopted. The stopcock for shutting down the supply is indicated at C. The branch and bibcock, as shown at D, are for the purpose of drawing the water out of the main after the stopcock C is closed. It is obvious that if this branch is not fixed, the main will not be emptied. The object of the second branch and bibcock (shown at E) is that in the event of the cock C being closed for repairs, etc., water can still be obtained when required. The pipes run outside should be kept at least 2 ft. 6 in. below the surface of the ground, to ensure their protection during hard weather. If, however, they have to be kept near the surface (as in the case of rocky ground), they should be fixed in a wooden trough, which is filled up with pitch or slag-wool. Stand-pipes should be wound round either with hair-felt or slag-wool, and a water-tight casing fitted to them. In garden supplies, a stopcock is generally placed beneath the ground, a small brick chamber, covered with a stone, giving access to it. A small bibcock must be soldered into the pipe, as close to the stopcock as possible, to drain the pipes when the supply is shut down. The chamber should be filled with slag-wool to prevent the pipe becoming frozen on the inlet side of the stopcock. The following simple precautions regarding water-closets erected at the rear of dwelling-houses should be observed: (a) Keep the door closed to protect the water-waste preventer and fittings from the wind; (b) cover the water-waste preventer with straw, or old sacking padded with hay or sawdust, and bind hay-bands or straw round the pipes; (c) throw a large handful of common salt into the closet basin every night, which will have the effect of lowering the freezing point of the water in the closet trap by 18° F. Many houses are built with the back kitchen or scullery wall forming the division wall between that room and the outside water-closet. In such cases the flushing cistern (water-waste preventer), with its supply pipe, might be fixed on the wall inside the scullery with advantage (*see* Fig. 509); and in addition, the supply pipe to the cistern could be provided with a high-pressure frost cock—that is, a combined stop and draw-off tap—which should be screwed down, and the draw-off tap of the cistern supply pipe opened every night, so that the pipe could be emptied, the cistern itself being emptied by pulling the chain. Water companies will not permit the fixing of an ordinary draw-off cock on the supply pipe of a water-closet, but some companies sanction a combined stopcock and draw-off cock (such as Whiteside's frost cock), so contrived as to prevent any undue waste or improper drawing-off of water.

Rust-choked Pipes.—The circulating pipes of a water jacket to the cylinder of a gas engine are found to rust very rapidly, and become choked. The use of copper pipe or Walker's tin-lined iron pipe would be a remedy; but to clear the existing pipes, lime in solution must be used. Slaked lime is not soluble when simply stirred in water, and lime water should be obtained from a chemist. This might be used for a week or two, in which time a thin encrusted lime deposit would appear on the surfaces, and this should stop the rusting. An artificial incrustation can be made by running a thick solution of lime white through the pipes, allowing it to dry thoroughly before letting the water in again. This is often successful, though it cannot be so effective as a natural deposit.

Rust Joints for Pipes.—The proportions for rust joints are 80 parts iron borings, 2 parts flowers of sulphur, and 1 part sal-ammoniac. The general practice is to fill the joint two-thirds full of yarn, soundly caulked in, then to fill the remaining third with the borings cement. The latter, when set hard, holds the yarn in place firmly.

Soldering Lead Pipes with Water in Them.—It is impossible to solder lead pipes whilst the water is in them. If, however, the water is not under any great pressure, a temporary "stop-back" can be inserted to hold the water back until

the soldering has been done. The stop-back can be a piece of well-kneaded clay, the crumbs of a piece of new bread, or a piece of dough made with very little water. To insert the stop-back it is necessary to sever the pipe. The clay is, or the bread-crumbs are, then crammed into the end from which the water is flowing, and should be pushed in for a distance of 8 in. or 10 in. from the end of the pipe. If the stop-back is too near the end of the pipe it will chill the solder and also be baked so hard that a considerable time will elapse before the water will soak through and wash it away. Six, eight, or ten inches of the pipe may have to be filled with the clay, or the bread, according to the water pressure that is to be resisted. In some cases it is necessary to make a pin-hole in the pipe, on the joint side of the stop-back, through which a piece of thin wire can be pushed to make a hole through the clay so that water may flow through and thus start a break-up of the material.

Sweating of Cold-water Pipes.—In all warm or hot rooms (except drying rooms) the heated air carries sufficient moisture to cause condensed water to show itself on any permanently cold surface. The remedy is to interpose something in the nature of a non-conductor of heat between the pipe and the air, by wrapping the pipe with hair-felt, or covering it with a wood case, this case being packed with hair or sawdust. An ingenious plan is adopted on some of the passenger vessels running between England and the Continent. The iron joists supporting the deck appear across the ceilings of the saloons and cabins, and if left bare condensed water would collect on these and drip from them. They are, therefore, given a coat of granulated cork, which quite stops the trouble. The cork is in grains about $\frac{1}{16}$ in. to $\frac{1}{8}$ in. in size. Apparently, the ironwork is thickly varnished, and the cork flung on to the sticky surface; and when all is dry, the surface of the cork is given a thin coat of white paint.

Tar-painted Pipes.—One way of removing smell from pipes painted with tar (assuming the pipes to be part of a glass-house heating system) is to clear out all the plants for a short time, open all the windows, and fire up well so as to get rid of all the volatile material from the tar. If this cannot be done, then it will be best to treat the pipes cold with benzene. It will be most advantageous to have the houses clear while this is being done, and keep all lights away so as to avoid any possibility of fire. Place some benzene in a pail and with this brush the pipes, allowing the excess benzene to fall into another bucket. After brushing, wipe the pipes clean with a cloth dipped in benzene. In this manner remove all the tar from the pipes, and open all the windows; next morning fire up, and in a short time the houses will be clear of fumes. A suitable wash for the pipes is slaked lime; or, if it is desired to have them black, use blacklead mixed with a very little gold size and sufficient turpentine to make it fluid.

Pipes, Tobacco (*see* Tobacco)

Pitch

Pitch is used extensively. It is obtained by heating tar until its volatile elements have been expelled. The distillation of turpentine also produces a kind of pitch. Burgundy or white pitch is a resin which flows from cuts made in the back of the Norway spruce and other conifers. Canada pitch is obtained from the hemlock spruce fir. Swedish pitch is produced by heating Stockholm tar (obtained during the manufacture of charcoal from pine-wood) until the liquid volatile portions have distilled over. Some kinds of pitch are mixtures, such, for instance, as chasers' and repoussé workers' pitch made by mixing 1 part of beeswax with 2 parts of resin and softening, as required, with sweet oil; there are other recipes.

Planes

These tools are used for smoothing wood which has been sawn to approximate size. A plane is essentially a chisel fixed in a wood block. The plane shown in Fig. 510 has been purposely cut away to show its construction: A is called the stock and is of wood, B is a wooden wedge, C is the cutting iron (actually of steel),

D is the back iron to give rigidity to the cutting iron and to prevent chattering, F is the screw and nut which fasten the two irons together; then there is the mouth clearly shown through which the shavings pass upwards and out. The jack plane is a long plane which is used on the sawn wood. Its parts are as already described, with the addition of a handle, called the toat. A still longer plane is the trying plane (actually truing plane) used for obtaining true surfaces on long lengths of stuff. The smoothing plane is a small tool agreeing with the one illustrated by Fig. 510, already described. There is a great variety of planes, some being of iron, some of wood with iron soles; then there is a large class of planes with peculiarly shaped irons for producing moulds and beads on the work. The rebate plane cuts a square recess on the edge of work. Full descriptions of these tools will be found in "Woodworking," a comprehensive volume produced under the direction of the editor of this book. The handyman is not likely to be possessed of more than one or two planes, and undoubtedly the two best adapted to his purpose are the jack plane and the smoothing plane. Others he can select as opportunity occurs, and as his skill in woodworking grows, but for the ordinary rough carpentry work of the household the two planes mentioned will be all-sufficient. As in these days it is so easy to obtain wood already steam-planed to a fairly good finish, the handyman can easily dispense with these tools, except for trimming up the sawn ends of work.

Avoiding Hammer Marks on Planes.—To avoid hammer marks on planes, caused by striking the upper part near the front end to loosen the wedge, the "Bazaar" suggests boring a hole of about $\frac{3}{4}$ in. or 1 in. in diameter and about $1\frac{1}{2}$ in. deep, and $1\frac{1}{2}$ in. from the end of the plane. A hardwood plug is turned to fit tightly into the hole, the plug being long enough when driven in for its end to stand about $\frac{1}{4}$ in. above the surface; this end is slightly rounded to prevent its edges from splitting under the impact of the hammer blows, which should always be delivered on this plug, instead of on the body of the plane. The plug should be inserted when the plane is new, and before it is used at all, because the first few hammer marks show very plainly; and it spoils the appearance of a plane to preserve these permanently by inserting a plug to hammer on after the surface has already been bruised.

Cleaning Planes.—To keep planes clean and smooth in appearance the grain must be filled. Clean off the surface with a steel scraper and fine glasspaper, rubbing along rather than across the grain. Rub with linseed oil sparingly on a clean rag. With a wadding or flannel rub with french polish, the rubber being freely wetted at first, but moist only afterwards. The porous surface of the wood will soon become smooth, and moisture and dirt will be less likely to stick. Work until all the oil has been absorbed and a slight polish appears.

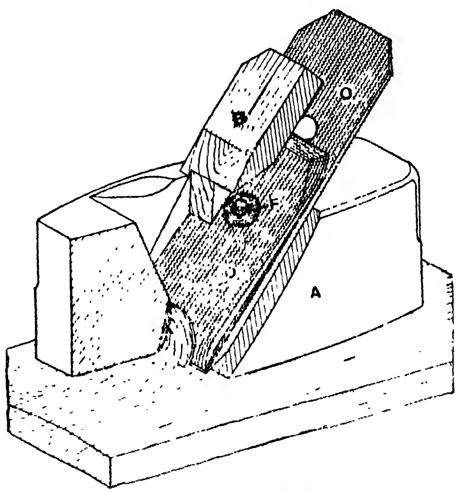


Fig. 510.—Diagram, showing Principle of Plane.

Plaster Casting

Making Cast from Clay Model.—As clay models can rarely be preserved, it is usual to cast them in plaster-of-Paris by the "waste-moulding" process. By this process, the model is encrusted with plaster to form a mould, the clay is removed, and

the mould is, instead, filled with plaster. Afterwards the mould is broken away and destroyed, hence the name. Plaster-of-Paris is sold in three qualities—superfine, fine, and coarse. The first is little used except for facing delicate work—such as small medallions; the second is used for facing both moulds and casts in ordinary work; of the last most of the thickness of the moulds is made, as well as the unseen parts of the casts themselves. The plaster is sprinkled with the hands into a vessel partly filled with water. Hard lumps are by this means detected and may be thrown aside, and, as the plaster is allowed to sink gradually, but few air bubbles are formed. When, instead of sinking, it begins to stand in heaps above the water, no more should be sprinkled in. Plaster only sets properly when mixed with a certain quantity of water, and by the above-described method it can be seen when the right proportions have been reached. The mixture is then well stirred together. For casting on a large scale, a pail will be most convenient to use; for smaller work, a basin. A spoon is put into the latter, and, by giving a circular motion to its bowl, without bringing it above the surface, the fluid is made to boil up. In a pail the naked arm and hand should be used instead of the spoon. Any scum and air bubbles which may arise to the surface are skimmed off. All this should be done briskly, though not hurriedly, or the plaster, if fresh, may set before it can be used. The ordinary practice is to make a waste mould in two distinct shells or layers, known as the inner and outer moulds, and it is desirable that the inner one should be coloured. What colouring matter is used is immaterial; ochre is often used, so also is common black ink, which slightly hardens the plaster. A mere tinge only is required—indeed, a deep shade might stain and injure the whiteness of the cast. The necessary quantity of water should be coloured before work is begun and poured into a second vessel to free it from sediment. Let it be presumed that a model of the ornamental keystone of an arch is to be cast. This is a simple affair, as the mould can be made in one piece only, whereas some models have to be moulded in two or more pieces. It is prepared by blowing water over in a fine spray, so as to improve the surface and cause the liquid plaster to flow more freely over it. Enough water to form pools in the hollows should not be put on, or the plaster will be softened and the mould made rotten in those places. A basin of coloured plaster being mixed of the consistency of cream, it is flung with the spoon or hand over the model, and forced into every hole and cranny; bellows are used for blowing it where it cannot be sent without them. Every part of the clay has to be covered to a depth of, say, $\frac{1}{8}$ in. While this inner shell of plaster is setting—which it should do in a few minutes—a mixture is made of clay and water as thick as puddle, and brushed over it. This film of clay is to prevent the outer mould from adhering too closely to the inner one. Fine plaster should be used in constructing the inner mould, but for the outer one coarse will suffice. This is mixed and flung over the inner shell in the same manner as before. It is usual to strengthen the outer mould with rods of iron so as to save plaster, and also to keep the mould from warping, which it is liable to do when it becomes heated in setting. Those who do much of this work keep by them a number of bars varying in length and thickness, and bent in different ways; but any odd pieces of iron will answer the purpose. When the outer mould is, say, $\frac{1}{4}$ in. thick, the irons are laid upon it in such a way as will most add to its strength, and they are then embedded by pouring on more plaster. The mould altogether should not be less than $\frac{3}{4}$ in. thick. Plain, not coloured, water is used for mixing the plaster for the outer mould. Whenever a vessel has been emptied, it should be rinsed out before more plaster is mixed in it. In half an hour the mould will have set, and the clay can be removed from within it. When a model is moderately flat, and has not many undercuttings, the whole may be extracted in a single lump. This is done rather by persuasion than by force. By pushing the clay, it is not difficult to make some little opening between it and the

plaster; water is poured into the opening, and the clay gently worked up and down. More water is poured in, and is induced gradually to spread over and soften the face of the model, which presently slips out. Low reliefs may thus be extracted almost uninjured, so that a second or even a third mould may sometimes be taken from them; but when the relief is high, with projecting masses, the clay has to be dug out piecemeal. After removal of the clay, the mould is well washed with soap and cold water. As any rough treatment might injure its face, a soft sponge is best for doing this; in hollows where a sponge cannot be used, a soft brush may be substituted. Finally, the mould is swilled out by directing a stream of clean water through it. The common idea that, before it is filled with liquid plaster, a mould must be dressed with grease, soft soap, or some similar substance, is erroneous. Except in very coarse work, any such dressing would do more harm than good. A cast will not adhere more closely than is desirable to a mould which is thoroughly saturated with water, though it will stick fast to one only slightly moistened—much faster, indeed, than to a dry one. After washing, it is well to fill the mould without unnecessary delay, for a fresh mould always chips off more satisfactorily than a stale one. The cast has first to be faced with fine plaster, which is mixed with plain water. It is, when ready, poured into the mould, which is gently rocked, so as to induce the liquid mixture to flow into and cover every part of it. Into crannies where it would not otherwise enter it can be blown with the bellows. The facing of fine plaster may perhaps be $\frac{1}{4}$ in. thick. Coarse plaster is then substituted, and continues to be poured in till the average thickness is $\frac{3}{4}$ in. A cast similar to the one in hand will scarcely need strengthening; but, when necessary, strips of slate or rods of metal may be embedded. When the cast has had time to set, the mould is chipped away with a blunt chisel and mallet. The outer po tion can be removed with a few strokes, and in a few pieces, for the film of clay between will cause it to leave the inner portion readily. Great care is needed in breaking away the inner shell. It is not desirable that it should leave too freely, or it may bring with it some of the projecting parts of the actual cast. It is safest to hold the chisel almost at right angles to the surface whilst at work. The colour of the inner mould—a lightish grey if ink has been used—renders it easily distinguishable from the pure white of the cast, so that there is small danger of driving the chisel into the latter by mistake. Any parts accidentally broken from the cast are stuck on with either liquid plaster or dissolved shellac.

Making Casts from Living Models.—To take a mould from a foot, place the latter on some soft material, as a pillow or several thicknesses of cloth, in order that there may be as little undercutting as possible, and to prevent the plaster, when it is poured over the foot, from running underneath. A little undercutting does not matter a great deal, as the flesh will give when the mould is removed. The foot must be thoroughly covered with sweet oil, not only to prevent the plaster from sticking, but to lay the hairs. If the oil has not enough body to do this, rub on a little vaseline. Now, in an earthenware basin, mix the plaster with warm water; this will have the double advantage of being more comfortable for the person operated on and of making the plaster set quickly. Put a spoonful of plaster on the highest part of the foot, allowing it to run down the sides. Continue this, blowing the plaster into the spaces between the toes. If the plaster in the basin has by this time become too thick to pour, take it by the handful and spread it over the thin layer already applied. The mould (which should be from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. thick) may be pulled off the foot as soon as the plaster begins to get warm in the process of setting, or even sooner if care is taken. One advantage of pulling off the mould as soon as possible, and before the plaster has become hard, is that any hairs which may not have been properly oiled down are not stuck to the plaster, and consequently the painful operation of pulling out the hairs, as in a hard-set mould, is avoided.

Instead of setting the foot on a pillow or cloths, soft clay or modelling wax (procurable from any artists' colourman) may be used. This will take an impression of the under side of the foot, and virtually act as a mould, the mould being then in two pieces—the plaster top and the wax under side. These two pieces may then be tied together, and the cast taken in the usual way. Another way is merely to cover with plaster, to a thickness of about ¼ in., the part to be cast, as described above, and when set break it off in two or three pieces, which may be joined together afterwards. Still another way is to immerse the oiled foot in the basin of gauged plaster, and when all is covered, take out the foot and lay on the remaining plaster. The foot may be released by laying a waxed thread, before the plaster is applied, along the top and underneath to the heel, or right round the sides. The waxed thread will stick to the foot, and when the foot has been plunged in the plaster, and the plaster is nearly set, take up the ends of the thread and rip up the mould, thus dividing it into two or four pieces as the case demands.

Plaster Casts

Bronzing Casts (*see* Bronzing).

Cleaning Plaster Cast.—Soak the cast in hot water, then with a stiff brush dipped in turpentine brush the cast over until the yellow colour is removed. A slight wash made of chloride of lime and water, brushed over the cast and afterwards dried, will bleach the cast whiter. It is usual to oil and then paint discoloured casts (for the necessary instructions, *see* Painting Casts, on p. 429).

Colouring Casts.—If a plaster cast is intended to be coloured throughout, the colouring matter is added to the plaster while gauging. Only certain colours will withstand the action o lime, and, consequently, all colours are not suited for admixture with plaster. A green that may be used is oxide of chromium or viridian. Subjoined is a list of different colours that may be used :—Light red, vermilion, burnt sienna, cadmium, raw sienna, yellow ochre, ultramarine, cobalt, vandyke brown, and ivory black. All colours are used in their powdered condition.

Hardening Plaster Casts.—There are several ways by which plaster casts may be hardened. Gauge together 6 parts of plaster and 1 part of finely sifted unslaked lime and cast in the usual way. When set, saturate the object with a solution of sulphate of zinc and water. If sulphate of iron is used instead of zinc, the cast will have a yellowish appearance. Gauging with alum water will also harden plaster, but it has the drawback of making the plaster set too quickly properly to cast certain objects. The addition of a little cream of tartar or size water will, however, retard the setting. Plaster may also be hardened by soaking in a solution of borax. Another method is to dry the cast in an oven heated to about the temperature used for baking bread. When the cast has cooled down so that it may be handled without burning the hands, immerse it in a strong aqueous solution of alum, and leave it there until crystals begin to form on the surface, then remove and wipe dry. Any crystals adhering may be removed with a wet rag. Now return the cast to the oven, and heat it to a temperature of about 140° F., and maintain it so until thoroughly dry. Remove and immerse in a bath of boiled linseed oil, cut with a little oil of turpentine. Let it remain for a few minutes, and then let the surplus oil drain back into the bath ; stand it aside in a warm place until the oil becomes "tacky," and then apply bronze powder.

Holes in Plaster Cast.—The small holes in a plaster cast are caused by bad casting. Only a small quantity of gauged plaster should be poured into the mould to begin with, and this should be sufficiently liquid to be shaken or blown into the smallest markings. When filling up any of these air holes the spot should be soaked with water before applying the fresh plaster. If this is not done, the cast will absorb the moisture from the newly applied plaster, preventing its proper setting and rendering it liable to crumble away.

Ivory Appearance on Plaster Casts.—Over a slow fire melt ½ lb. of beeswax with 1 pt. of turpentine, and apply to the plaster

by means of a soft brush. Several successive coats are necessary to cover the plaster well. If the mixture is too thick, add a little more turpentine. Plaster casts may be coloured by including a tint in the wax and turpentine.

Mending Broken Plaster Cast.—Assume that the leg of a plaster model of a dog is broken off, and that it is to be repaired. Dissolve a small quantity of shellac in alcohol and apply a thin coat to the fracture. Press together firmly and hold in position till the shellac has hardened. If the cast is old and dry it is advisable first to apply to the broken surfaces a coat of shellac, allowing it to harden before adding the final coat. Broken casts are also mended by using freshly gauged plaster. The cast must, however, be well saturated with water before the fresh plaster is applied, otherwise any moisture it contains will be immediately absorbed by the dry cast before the fresh plaster has had time to set. In the case of broken arms or legs, the cast should be first softened by soaking in water, and, after cutting a hole in each part, the holes should be filled with freshly gauged plaster and a strong wire inserted. Press the parts together till the plaster is set. The plaster which is pressed out at the joint should be removed with a wet modelling tool.

Painting Casts.—The cast should be brushed over with linseed oil, so as to "satisfy" its power of absorption. When dry, if it is to be painted white, mix white-lead with a small portion of linseed oil and a large portion of turpentine, and stipple this over the surface with the end of a brush, so as to leave as little paint as possible; to brush the paint on in the common way might choke or hide any delicate forms. A second coat may be desirable when the first is dry. The surface thus gained will be a dead one, not shining like ordinary paint. If the cast is to be gilded, it must, when dry from oiling, receive a coat of oil gold-size; the best for the purpose is sold by colourmen as a paste and is coloured yellow. This can be thinned with linseed oil to make it work freely, and brushed over the cast. When, after a few hours, it is so far dried as to be merely tacky, the gold-leaf can be laid on, and gently pressed down with a tuft of cotton-wool. It only remains to rub off the superfluous gold with a bit of cotton-wool. It is an easy matter to gild a small cast, and the effect is good.

Polishing Plaster Casts.—(1) Take 1 oz. of white beeswax and 1 oz. of white curd soap; cut them into thin slices, and put them in an earthenware vessel. Add 2 qt. of boiling water, then place the vessel in an oven till the whole is dissolved. The plaster cast must be perfectly clean and dry—so dry that when the thumbnail is pressed against the plaster it will give a sharp ringing sound. Then heat the plaster, either by suspending it before the fire with a wire or placing it in the oven. When the wax and soap are dissolved, steep the hot plaster cast in the solution for about a minute; take it out, and blow away any superfluous liquid on its surface. Dip it a second time for half a minute, and then cover it up for a few days to dry. A bright polish can be brought to the surface of the plaster by rubbing with a clean linen cloth. (2) Skimmed milk is capable of imparting a bright gloss to plaster. Warm the cast, and immerse it in skimmed milk, or paint it on the cast until it will absorb no more. Blow away any superfluous liquid from the corners or recesses, and cover it up. When dry, a bright, hard, glossy surface will be the result. (3) Steep a dry, hot plaster cast in melted white wax for about two minutes; let it dry thoroughly, and a fine polish can be raised on its surface with a linen cloth. (4) Dissolve 2 oz. of white beeswax in a pint of hot water and dip the cast in the solution. Take out the cast and allow the wax to soak in. Repeat the operation three or four times. Cover the cast to prevent dust settling on it and set aside for a few days, then polish with cotton-wool or a soft rag. In the same way, casts saturated with olive oil in which a little white wax has been dissolved, or even paraffin wax alone, will take a good polish. By adding some colouring matter to these dips the cast may be tinted to any desired colour.

Waxing Casts.—Proceed as described in the previous paragraph, or as follows:—Have

the melted white wax in a vessel big enough to receive the cast, which must be thoroughly dry and heated before putting in. When the wax rises to the surface of the exposed parts it will show that saturation has been reached.

Plaster-of-Paris

Plaster-of-Paris, says Jacques Boyer in the "Engineering Magazine," is obtained by the calcination of gypsum, or sulphate of lime, which is found in vast beds in the neighbourhood of Paris. Legend attributes its discovery to a shepherd of Montmartre: cooking his food in an open-air fireplace, built in part of blocks of gypsum, he unwittingly manufactured plaster-of-Paris, because a shower following wet the plaster, the dehydrated blocks of gypsum cementing together the adjoining stones, thus pointing the way to a discovery of the utmost usefulness to humanity. This is probably imaginative rather than authentic, but it is certain that plaster was known to the ancients, as Aristotle and Pliny bear witness. It was employed first for making casts. It still serves the same purpose throughout the world, the chief supplies being drawn from France; but gypsum is found also in America, England, Italy, Greece, and Germany. Its more important industrial use, perhaps, is found in building construction; the recent enormous increase in the use of concrete has been reflected in an enlarged demand for plaster, which is introduced into cement in large or smaller proportion to control the speed of setting. Gypsum is the hydrated sulphate of lime ($CaSO_4 2H_2O$), which loses its water of crystallisation on heating and becomes plaster-of-Paris ($CaSO_4$). The chief use of gypsum is in the manufacture of plaster, but a fine-grained massive variety, pure white or veined with red, yellow, or grey, is used for statuary purposes under various names, including alabaster. The crystalline variety is known as selenite, and another crystalline variety with a silky lustre is called satin-spar. Gypsum is usually found in association with clay or marl and rock salt, in basins, and has no doubt been formed by the evaporation of the water in inland seas and lakes like the Dead Sea and the Great Salt Lake of Utah; it is the first substance to separate on the evaporation of water containing large quantities of salts in solution; it is also found in volcanic districts as a product of the action of the sulphurous gases upon limestone. There are three qualities of plaster-of-Paris in the market—"superfine" and "fine," sold in casks of 2 cwt.; and "coarse," sold in sacks or bags from 7 lb. upwards. Weight per strike bushel equals 64 lb., weight per cubic foot equals 50 lb. When the gypsum is a translucent or nearly opaque white, it is known as alabaster, and is used chiefly for statuettes and ornaments. When coloured in mixed yellow and brownish shades, it is familiar as Derbyshire spar, also used for vases and ornaments. Plaster-of-Paris forms the basis of Keene's cement, which is plaster-of-Paris and alum; Parian cement, which is plaster-of-Paris and borax; Scagliola and Marezzo marble. It is the essential element in selenitic mortar, or Scott's cement, where the addition of 5 or 6 per cent. of plaster-of-Paris to a feebly hydraulic lime checks the slaking and expedites the setting, permitting also a larger quantity of sand to be used without weakening the mortar.

Hardening Plaster-of-Paris.—Mixing plaster-of-Paris with filtered rain-water or sour milk gives a very hard material in twenty-four hours, the hardness being increased by the previous addition of marble dust, or 1 part of sal-ammoniac to 15 parts of the plaster. The plaster is best prepared, says an authority, by placing it in the form of a cone into a dish and then pouring in the liquid until it is absorbed up to the apex of the cone. Then, and not until then, the mixture should be stirred; it must, of course, be used immediately. A method of hardening plaster-of-Paris is to mix an aqueous solution of ammonium borate with the plaster in the act of moulding, or to coat the finished cast with the solution. The latter is prepared by dissolving boracic acid in warm water and adding sufficient ammonia to form the borate. The treatment of the plaster is carried out in a cold atmosphere. Walls of buildings can be made impervious to moisture by saturating with this solution.

Plaster-of-Paris Failing to Set.—Plaster-of-Paris will not set properly if, when mixing with water, it is stirred or handled too much. The setting properties will also be affected if the plaster is old or has been kept in a damp place. Another reason might be gauging the plaster too thin.

Preventing Plaster - of - Paris Setting Quickly.—Glue size is perhaps the best thing to use to retard the setting of plaster-of-Paris. It will also render the work, when set, extremely hard and tough; in fact, it is always advisable to immerse plaster casts in size to render them unbreakable. Sugar may be used by dissolving half a tea-spoonful in a quart of the gauging water. Sulphate of zinc added to the water has also a marked effect in retarding the setting and increasing the ultimate hardness of plaster. Ammonia, stale beer, and urine are also used.

Plate Glass (*see* Glass)

Platinum

Platinum (symbol Pt, and specific gravity 21·5) is one of the heaviest metals; its atomic weight is 195·2, and its melting point 3080° F. (1693·3° C.). It is brilliantly white, soft, malleable, ductile, tenacious, and is easily welded. It is fused only by a compound blowpipe flame, an oxy-hydrogen flame, or by the electric arc. It resists the action of moisture or single acids, although aqua regia dissolves it, but not readily. It is largely employed as an ingredient of many important alloys. Platinum occurs native, and also in combination with iridium, rhodium, palladium, gold, copper, iron, osmium, lead, etc. It is recovered from the ore by one of two methods—wet or dry.

Coating Aluminium Vessels with Platinum.—The platinising of aluminium vessels has been recently recommended, the platinised vessels being used as a substitute for platinum vessels when not required to stand a very high temperature. The process of platinising consists merely in rubbing the aluminium surface, previously polished, with platinic chloride, rendered slightly alkaline. The layer of platinum is made thicker by repeated application. Potash lye is carefully added to a solution of 5 per cent. to 10 per cent. of platinic chloride in water till a slightly alkaline reaction is produced on filtering paper or a porcelain plate by means of phenolphthaleïn. This solution must always be freshly prepared. Neither galvanising nor amalgamating will produce the desired result. Special care must be taken that the aluminium is free from iron, otherwise black patches will arise which cannot afterwards be removed. Vessels platinised in this way must not be cleaned with abrasive substances, but with a 5 per cent. to 10 per cent. solution of oxalic acid in water, followed by thorough rinsing in water. These vessels are said to be specially suitable for evaporating purposes.

Spongy Platinum.—Spongy platinum is used in automatic gas-lighters. It is prepared by heating the double chloride of platinum and ammonium, or, as it is also called, ammonium platinichloride ($(NH_4)_2PtCl_6$). If asbestos be soaked in a solution of platinum chloride and a solution of ammonium chloride, mixed together, and then dried and ignited, a deposit of spongy platinum is formed on the asbestos, which then becomes a cheap substitute for the pure material. If the spongy platinum is required in balls, these balls should be cut from pumice-stone, which may then be treated in the manner described above. Spongy palladium is far more active than spongy platinum for igniting gases, and is prepared in the same way as the platinum, palladic chloride being used instead of platinic chloride; palladic chloride costs, however, about three times as much as the platinum compound.

Utilising Platinum Scraps.—To utilise scraps of platinum, dissolve the pieces in aqua regia (3 parts of concentrated hydrochloric acid and 1 part of concentrated nitric acid). The liquid in excess is evaporated, and the platinum chloride left to crystallise.

Plug Cocks

Re-grinding Plug Cocks.—To re-grind plug cocks properly, considerable experience and skill are necessary, and without such experience and skill a good cock may be entirely spoilt. Fine loam should

be used, as grit stone and emery powder are too cutting. The head of the key is held in a vice and the body turned on the key by the workman's hands. Sometimes it is necessary to file slightly prominent parts in the face of the key or the inside of the barrel by using a fine float. When a key is much worn it enters the barrel too far, and the key has to be turned shorter in a lathe and the bottom screw thread cut longer. Sometimes a new bottom brass washer has to be made and fitted. In a brass finisher's workshop the grinding is done by the most experienced man. Much the quickest way of grinding plug cocks is in the lathe, but, of course, the work requires skill.

Plugging Walls

It is a mistake to drive nails direct into a wall. The risk of damage to the

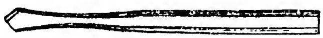


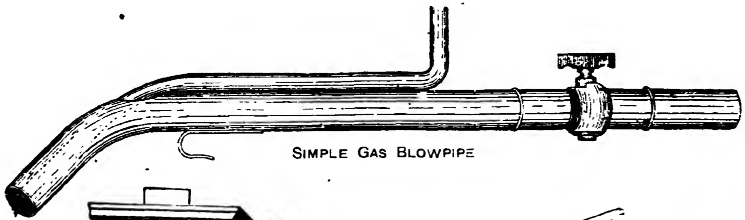
Fig. 511.—Drill for Making Plug Holes.

Fig. 512.—Wall Plug.

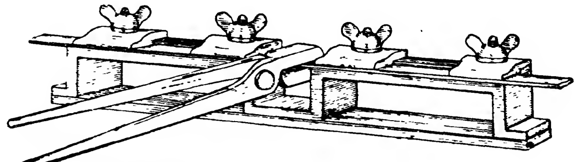
Fig. 513. Fig. 514.

Figs. 513 and 514. Brass Ear-plates.

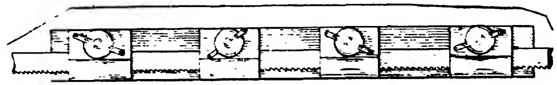
wall is great, and the hold of the nail is generally but slight. Nails should be driven into wooden plugs previously inserted in holes properly drilled in the wall. For fixing picture rails, overmantels, curtain rod brackets, etc., plugs should always be used. For the sake of the appearance of the wall as well as for the strength of the job, the plug holes must be carefully made. A suitable drill for the job is made of wrought steel to the shape shown in Fig. 511, the stem being $\frac{1}{2}$ in. in diameter, and the point $\frac{5}{8}$ in. wide by $\frac{3}{16}$ in. thick. The point is hard, but the butt end is soft so as not to chip when struck with the hammer. This drill is used by striking it smartly with the hammer, turning it slightly between the strokes; by its use holes can be made in the bricks in less time than it would take to find a joint. Each hole should be drilled to a depth of about 2 in., so that the plugs have a solid hold in the bricks of $1\frac{1}{2}$ in. The plugs should be square and slightly tapered, as shown in Fig. 512. If the wood is cut off to 2 in. in length, and split into squares of barely $\frac{5}{8}$ in., they can be easily and quickly finished by taking off a thin chip from each side with a chisel. Round plugs made with a dowel plate do not hold so well. Overmantels, of course, as a rule rest on the mantelpiece, and some workmen merely drive two brass-headed nails through the ear-plates; but considering that the nails can often easily be pulled out with the finger and thumb, this is a very unsatisfactory method of fixing, and any unusual vibration might cause the overmantel to fall forward. If a picture moulding runs behind an overmantel or a pier-glass to be fixed, it is advisable to shift the ear-plates to a position to screw to it, otherwise the wall should be plugged. This does not mean making a mess of the wall, as many suppose. When a heavy pier-glass is to be fixed, two brass ear-plates (Figs. 513 and 514) are screwed on towards the top, the pier-glass is lifted into its place, and the wall is marked through the ear-plates. The glass is then pushed a few inches to one side, and the marked place is then plugged; the wall on the other side is next treated in the same way, when the glass can be put in position and secured with brass-headed nails. The plates cover the plugs, and the wall is none the worse. If the chisel strikes a joint between the bricks, the holes are more easily made; but when plugging, or even driving nails into walls it is always well to watch for gas or water pipes, or electric wires, and the feel of a lead pipe can always be recognised. In fixing hanging bookcases, the weight of the books should be taken into consideration, and it will sometimes be necessary to put in as many as six plugs. For light articles, such as brackets, hatrails, clocks etc., the ear-plate shown by Fig. 514 will be suitable, as the article can be lifted off if required. The ear-plates should be large enough, or the edges of the article may be damaged in fixing up.



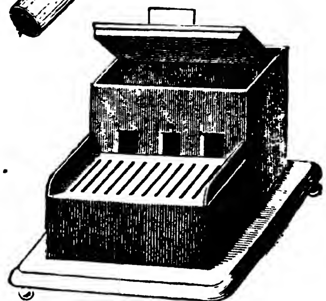
Simple Gas Blowpipe



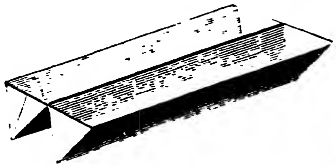
Apparatus for Brazing Band-saw



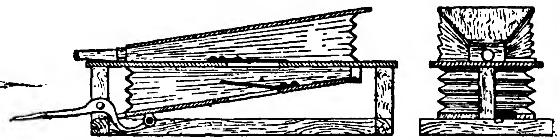
Plan of Apparatus for Brazing Band-saw



Stove for Soldering Bits

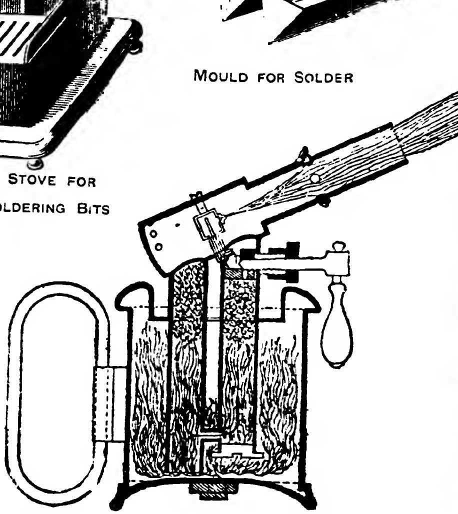


Mould for Solder

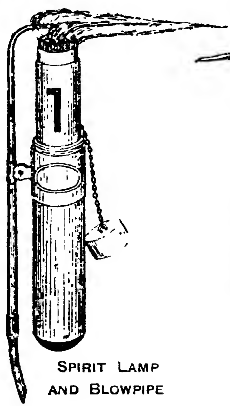


Elevations of Simple Bellows

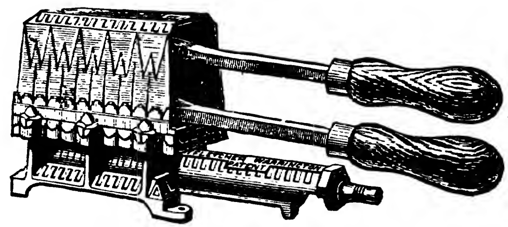
Simple Mouth Blowpipe



Section of Benzoline Soldering Lamp



Spirit Lamp and Blowpipe



Gas Stove for Soldering Bits

Plumbago (*see* Graphite)

Plush, Ink Stains on

Oxalic acid dissolved in water is one of the best solutions for removing ink stains, but in dealing with plush it would be necessary to consider whether the colour of the plush would not be injured by the acid. Try a little of the acid on a bit of the plush that is not in sight. If the result is satisfactory, sponge the stains with the oxalic acid, and when they have disappeared, sponge with water.

Poker-work or Pyrography

A good deal of the poker-work of the present day is most artistic, some of it looking like sepia drawings, some having the appearance of walnut, inlaid with ivory, according to the style employed. The box of apparatus, as purchased, used to cost about 25s., but the price is now considerably less, ranging from a few shillings up. It contains a wide-mouthed bottle, with two brass tubes fixed in the cork. To one of these tubes is connected a long rubber tube, ending in a ball, like that on the familiar "spray-producers"; to the other is connected a shorter rubber tube, which goes to the handle of the pencil. The pencil itself is a metal tube, with a wooden handle, the point of the pencil being of platinum and removable at pleasure, the points being obtainable in a variety of patterns. Of the chief two, one is about as sharp as an ordinary lead-pencil is made, the other having a broad rounded point, bevelled to a chisel-edge each side. Inside the point, but of course invisible, there is a small spiral of platinum wire; and about an inch from the point there is a small hole, to let out the burnt vapour. The outfit includes a spirit-lamp; but this is not at all necessary. The whole apparatus is based on the fact that a spiral of platinum wire, when sufficiently heated, will, if held in a stream of the vapour of benzine, alcohol, etc., remain red, or even white hot, as long as the vapour impinges upon it. As to the method of working, the bottle is half filled with benzine; then the cork is fixed on tightly, the rubber tube from the pencil fastened to one of the brass tubes in the cork, and the rubber tube from the ball fastened to the other tube. The point of the pencil now requires to be heated. This may be done by holding it in the flame of the spirit-lamp; then, after half a minute or less, on squeezing the ball with regular puffs, the end of the pencil will begin to glow. The pencil is then to be held in the one hand, to make the drawing, etc., while the ball is kept in the other hand, to pump the vapour down into the pencil; at first it is rather bothering to have to keep pumping the whole of the time, but after a while the hand squeezes the ball almost automatically. If the ball is squeezed hard and quickly, the pencil becomes white-hot; but this is not at all advisable, for at a white heat the platinum is apt to become somewhat soft; and besides, at that heat the wood generally takes fire every time the pencil touches it. After a little practice it will be found very easy to regulate the heat to just the point suitable to the particular wood which is being operated on, or to the design which is being drawn. Naturally, a hard wood will bear a much higher degree of heat than a soft one; and a design of fine lines requires the pencil to be cooler than one which has only thick lines in it. As to the wood for the work, articles made of soft white wood, such as glove and handkerchief boxes, photograph frames, small folding-tables, milking-stools, blotting-cases, etc., can be bought specially, or made by a woodworker possessed of some skill. Brown woods are not very effective, as there is so little contrast between them and the colour of the work. Pine is to be avoided, or any wood with a strong grain; for in drawing a line, as soon as the pencil crosses a vein it leaves it almost untouched, but it digs in as soon as the vein is passed. Articles for this work need not be nearly so thick and solid as for carving, for the design does not penetrate far. On the other hand, a broad flat surface, like a wooden plate for a lamp-stand, etc., must not be too thin, or else the heat may buckle it. Designs can be drawn directly on the wood, in pencil; otherwise, ready-made designs can be easily transferred.

A sheet of carbon-paper is laid, black side down, on the wood, the design stretched over that, the whole secured with two or three drawing-pins, and then every line of the design carefully and steadily gone over with a bone-tracer, or knitting-pin, or anything with a smooth hard point that will not tear the paper. When the design is drawn or transferred, the poker-work can be begun. Owing to the heat, even the wooden handle is unpleasantly warm after a few minutes' work; but better pencils are fitted with cork handles, which are both cooler and lighter to use. A great improvement is effected if the wooden handle from the pencil of the apparatus is taken off and wound round with cotton-wool before replacing it; that is to say, the wool is wrapped round the metal tube of the pencil, and then the wooden handle slipped on over that. It is quite impossible to hold the pencil close to the point, in the manner of a drawing pencil; so the worker must learn to use it with something like 3 in. projecting from his fingers. Owing to this, a rest for the hand is almost a necessity; a book or anything will do that will raise the hand an inch or more above the design. A start should be made with outline designs in which all the background is left white; but it would be as well to practise first upon a piece of waste wood, so as to learn how to draw a line. If the pencil moves too rapidly, the line will appear to be dotted; that is, the pencil fails to burn a continuous line; while if the movement is too slow a deep burn will be ploughed in the wood, far broader and deeper than the design probably requires. The pencil should be kept at one uniform, fair red heat all the time, which depends altogether upon the blowing. Should it go out at any time, it must be heated again in the spirit-lamp; or if the pencil be laid down so that half of it projects over the edge of the table, a lighted match held under it will almost always supply sufficient heat to cause it to glow as soon as the ball is pressed. Shading can be done with lines in the ordinary way; or the broad point to the pencil may be employed for massive effects. When the broad point is on, it is not advisable to blow too hard, as the edge is very thin, and it becomes white-hot much more easily than the ordinary point. Floriated or arabesque designs will be found more satisfactory than strictly geometrical ones, containing straight lines, as two parallel straight lines, for instance, are very difficult to draw evenly; and when a mark is made with the pencil it cannot be rubbed out, but must remain. The work can be varnished, after completion, if desired. The second manner of working mentioned is to leave all the design untouched, and to fill in the background with dots. This is much more tedious, but looks very handsome, and resembles inlaid work at a little distance. Dot or draw round the edges of all the lines (of course, leaving the lines themselves untouched), with the pencil held quite perpendicularly; and when the outline is complete, proceed to fill in the whole of the background with similar dots. The pencil must be held very firmly, else, on coming to a softer part of the wood, it will dig in, making a hole four or five times too deep and too broad. Wood is not the only material used for poker-work; leather looks fairly effective, and the pencil will mark horn, and even bone and ivory; but for the latter two it must be hotter than is necessary for wood. The markings are, of course, indelible, unless actually scraped out. The following cautions will be found useful. If a smoker, do not light your pipe with the pencil. The tobacco-ash forms a hard crust on the outside, difficult to remove. Be careful not to put the point in the mouth. This sounds absurd; but those accustomed to wetting an ordinary pencil to make it mark better may easily do the same with the platinum pencil in a moment of absence of mind, and get a severe burn. Keep the pencil away from the rubber ball while hot; and if the pencil has to be laid down at any time, the proper place is with the point projecting over the edge of the table. Do not fill the bottle more than half full of benzine. The reason for this is that it is the vapour, and not the benzine itself, which is required; and if the bottle is too full, there is not room enough in it

for the vapour. Lastly, remember that benzine is exceedingly inflammable; and though the machine is quite safe when there are no leaks, it is wiser not to open the bottle anywhere near a light. As to the bottle itself, its proper place, while working, is in the box, where a compartment is specially provided for it. In that case there is no danger of upsetting the bottle, which will be sure to happen sooner or later, if the bottle is placed on the table. Leakages may occur where the short brass tubes go through the cork, and between the cork and the neck of the bottle. A leakage is unpleasant, as it causes a nasty smell of benzine; it is dangerous, as the vapour is liable to catch fire; it is wasteful, as much more is used than would be otherwise necessary; and it causes more labour, as with a leak one has to blow much harder to keep up the pressure. See that the cork is soft; fix it firmly in the bottle, pinch the tube just before it joins the pencil, and then work the ball and listen. If there is the slightest hissing, there is a leak. If it is where the brass tubes go through the cork, it can be made good with sealing-wax (not lighted near the open bottle). If the cork is unsound, get a new one. While at work, there is a stream of hot air coming out of the little hole near the end of the pencil; this hole should, of course, be turned away from the operator. There is always a little smoke from the burning wood; but, unless the pencil is very hot, it is not enough to cause inconvenience.

Finishing Poker-work.—The finishing of poker-work by polishing is not an easy matter. The use of a grain filler on such work is not advised. The better plan is to give at least two coats of isinglass—½ oz. of isinglass to 1 pt. of hot water. Clear off any scum and allow it to get cold before applying. It should be laid on with a camel-hair brush and passed from right to left, not brushed about; allow one coat to dry before applying the next. When quite dry, smooth with fine worn glasspaper, then give two coats of best white hard spirit varnish. A superior finish may be gained by smoothing this down when hard and french polishing on the top, using what is known as white or transparent polish.

Polishes (*see* Boot Polish, etc.)

Polishing (*see* French Polishing)

Posters, Removing

To remove posters from walls, use a strong solution of potash as a pickle, put on with an old brush in the same manner as painters remove old paint, using a scraper or old knife to get off the paper as it softens.

Potassium Bichromate

Bichromate of potash is sold in the form of orange-coloured crystals, and readily dissolves in cold or hot water in a few minutes. The solution acts chemically on the fibres of light woods, thus turning the upper surface much darker; but, to ensure that it shall strike into all portions alike, the woodwork to which it is applied should be perfectly free from grease, wax, glue, polish, or varnish. The stain may be applied with rag, wadding, a sponge, or a brush. It is a good plan to apply it rather liberally, then to wipe off the surplus with another piece of rag. Any kind of varnish may be used for finishing wood stained as above, though spirit varnish with a tinge of red in is generally employed.

Potassium Permanganate

Potassium permanganate is prepared by heating to redness for several hours, in a shallow dish, a mixture of caustic potash and manganese dioxide, otherwise known as black oxide of manganese. The fused mass has a brilliant green colour, and is composed of manganate of potash. It is dissolved in water, and treated with the requisite quantity of sulphuric acid to convert it into permanganate; the solution is then evaporated, and the sulphate of potash separated by crystallisation. The solution is then further concentrated, and the permanganate crystallises from it in blackish-red needles. Permanganate of potash is used principally as a disinfectant owing to the fact that it will give off oxygen on contact with putrefying organic matter and thus destroy the putrefaction.

Preservative Powder

A preservative powder is bisulphite of soda, or acid sulphite of soda as it is sometimes called. This material, when dissolved in water, forms a useful antiseptic, and will prevent taint in meat, etc., for a few days, but will not altogether prevent decay, as its action becomes gradually weakened on exposure to air. The product is then changed into sulphate of soda, which is harmless. Bisulphite of soda is not a dangerous chemical, and yet it cannot be considered harmless except in very small quantity; but in moderate quantities would certainly be very injurious, and would give a distinctly unpleasant taste to anything with which the powder might be mixed. The use of preservatives in food products is prohibited, except that a small quantity of borax is allowed to be added to butter and cream.

Prints (including Engravings, etc.)

Bleaching Old Prints.—To bleach old prints, prepare three solutions as follows: (a) Mix 2 oz. of chloride of lime with 1 pt. of water; dissolve 3 oz. of washing soda in 1 pt. of water, and mix, allow the precipitate to subside, and use only the clear liquid. (b) Dissolve 1 oz. of sulphite of soda in 1 pt. of water. (c) Add 1 pt. of water to 2 oz. of strong pure hydrochloric acid. A shallow dish large enough to take a print will be required. Place water in the dish and float the print in it till thoroughly wetted. Now remove the print, add 1 oz. of solution (a), and replace the print; allow it to remain for a few hours: if thoroughly bleached run off the liquid, wash the print in running water, then add a few drops of (b) solution; allow to stand for about an hour, again wash in running water for about an hour, remove the print to clean white blotting paper, drain, and dry. If the print is not properly bleached by (a) solution, pour off the latter, add water to the dish and a few drops of (c) solution, allow to stand, wash, treat with (b) solution, and finish as above described.

Colouring Prints.—Place the print face upward on clean cardboard; put weights on the corners to keep it down, and pass a piece of stale bread gently over to remove any surface dirt. Now prepare the requisite tints in water-colour, and lay on broad washes with a large-sized camel-hair pencil. Large tools must be used where much ground has to be covered with any colour, as the absorbent nature of the printing papers in general use renders it impossible to get an even tint otherwise; indeed, it will often be found necessary to allow large surfaces, such as sky, etc., to absorb a considerable quantity of water (applied evenly with a camel-hair tool) before the laying-in of colour is attempted. Body colour—that to which white has been added—is used sparingly, and only, as a rule, to heighten the effect of jewellery, armour, etc. When the colouring is finished, pass carefully over the deep shadows with a weak solution of gum arabic. This gives force to the work and depth and transparency to the dark parts. The gum must not be used strong, or it will crack immediately the print is rolled.

Mounting Engravings Printed on Silk.—The safest plan is to lay the silk face downward on a drawing-board, and then drive in a row of tacks all round the silk, about 2 in. or 3 in. from its edge. Next, opposite each tack, take a stitch with needle and thread through the silk (going just far enough into the material to get a firm hold), and secure the thread by winding it round the tack. When this has been done all round, the threads must be very gradually tightened, special care being taken that the fabric is not pulled awry. By this means, if due patience and care are exercised, perfect smoothness may be secured: because the threads are only lightly fastened by a few turns round the tacks, and can be unwound and tightened anywhere as required. A piece of millboard that has been glued round the edges only is then laid on the silk, and pressed until the glue has set. The silk can then be turned face upwards and mounted.

Pasting Prints in Scrap-book.—Touch the corners only of the print with a mixture of glue and paste; then, if the picture is dropped into position and pressed down, it will lie smooth. When it is necessary to paste a print all over, the paste should

be allowed to set partly before mounting, and a very thin coat only applied; then, while the prints are wet, close the book and place heavy pressure upon it. However, no precaution will entirely prevent wrinkles on a paper so thin as cartridge.

Preserving Printed Matter.—Printed matter will not fade, because printers' ink, being coloured with carbon, is practically indestructible under ordinary conditions. The discoloration of the paper, as a rule, is due to the effect of the residual bleaching material left in the paper pulp when it was made—that is, chloride of lime; in good paper, however, "antichlores" are now used to destroy the excess of chloride. Newspapers, being made of common stuff, are sure to become brown and rotten in time. Dampness also causes the growth of microscopic moulds, which destroy the fibres. The discoloration may be prevented to some extent by keeping the paper in a thoroughly dry place. If expense is not objected to, a thin varnish of collodion will help to keep the paper a good colour.

Removing Age Stains from Prints.—Mere age stains can be removed from engravings by placing the latter in a shallow tray (a tea-tray, for instance) containing water, and exposing them to the rays of the sun till bleached, when they should be allowed to dry naturally. When dry they can be ironed with a hot iron, over several folds of linen, to take out all creases, etc.

Removing Damp Stains from Prints.—Stains caused by damp, etc., are removed by the following method:—Cover the engraving in a glazed earthenware tray with clean rain-water till the paper is saturated; then pour off the water, and substitute a solution of chloride of lime strained through muslin. The moment the stain disappears pour the solution away, and rinse the engraving in clean water. Then dry, and ensure smoothness by stretching the paper.

Removing Grease Stains from Prints.—(1) To remove grease stains, lay a sheet of muslin in a tea-tray, and on the sheet lay the engraving. Take the whole into the open air and with a soft wash-leather pad well sponge the yellow stain with petroleum spirit or spirit of wine. Do not in any case attempt to do this indoors or near artificial light, as the spirits are highly inflammable. When the stain has been removed, lift the muslin and engraving together from the dish to a table, and cover the face with blotting paper, placing over this a sheet of brown paper, and then a sheet of calico. This done, turn the whole over, remove the muslin back, replace with blotting paper, brown paper, and calico, and submit the whole to gentle pressure until dry. (2) Lay the engraving between several folds of clean blotting paper, and pass a hot iron over it. Continually change the paper and repeat the ironing.

Removing Ink Marks from Engravings.—Dissolve 3 oz. of washing soda in 20 oz. of water, and mix with a solution of chloride of lime, 2 oz. in 20 oz. of water; after mixing, filter. Now take 2 oz. or 3 oz. of the above solution and 10 oz. of water, and soak the engraving in it for about fifteen minutes; remove and soak in dilute hydrochloric acid (1 part acid to 10 parts water) for the same length of time; again remove, and wash for one hour in running water, then dry.

Transferring Prints.—Printing ink may be loosened and rendered transferable by several substances, but probably the best are creosote, or oil of tar, and balsam of copaiba. To obtain a reversed picture, brush a plentiful quantity of creosote (6d. per oz.) quickly over the original print. It acts immediately, so be careful not to smear the ink by unnecessary brushing. Dissolve 1 oz. of common soda or 1 oz. of oxalic acid in 1 pt. of water, and moisten the paper on which the reversed impression is to appear. When the creosote has soaked well into the print, transfer by placing it face downward on the damp paper and rubbing the back with any smooth, hard article, and a clear picture will be the result. Transparencies are made by coating the paper with a mixture of one part Canada balsam and two parts spirit of turpentine instead of the soda or acid solutions, and letting it dry thoroughly before transferring the picture.

Balsam of copaiba (4d. per ounce) must be applied sparingly, and then well and thinly brushed over the print, or it will remain on the surface, as the paper can only soak up a limited amount. It penetrates far less quickly than creosote, so requires to be left some time before transferring is commenced. Dry, unprepared paper is best, and friction at the back should be employed as already explained. For transparencies, coat the paper with mastic or crystal varnish, allowing it to dry before placing in contact with the prepared print. Reversed pictures look equally as good as the original, but reversed reading matter is illegible to the majority. If a facsimile is required, put 1 oz. of best white gum arabic in 8 oz. of cold water and shake frequently until dissolved. Then strain it, and give some good paper two thin coats. When dry, apply a coat of white, hard spirit varnish and leave it for at least thirty-six hours. Prepare a print with creosote and transfer to the varnished paper; leave it a few hours, then put a thin layer of spirit varnish on the exposed reversed print, and cover with a suitable piece of stout white paper, smoothing it carefully and evenly down; place it under a few heavy books and let it remain there for two or three days. When perfectly dried, steep it in cold water until the gum gives way and the first sheet of paper floats off without any coaxing; then immerse the print in hot water to remove all traces of the gum still clinging to the face of the picture, and the desired facsimile is obtained nicely covered with a protecting film of varnish. Should balsam of copaiba be used, coat the gummed paper with crystal varnish instead of white hard, and proceed as before; of course, crystal varnish must be applied to the reversed print when attaching the back sheet of paper. To take several copies from one original the following paste is necessary:—Soak ½ oz. of gum tragacanth (4d. per ounce) in 5 oz. of water for twenty-four hours, then boil it in a double vessel till melted, add ¼ oz. of common washing soda, and let it simmer. Mix 1½ oz. of white starch in 2 oz. of water, and turn it into the hot liquid, letting it boil till quite clear, instead of being dull and milky-looking. Put 3 oz. of powdered whiting in 10 oz. of water, beating well together before adding to the above, stir all up thoroughly, gradually putting in 1½ oz. of glycerine, and, lastly, add 6 drops of creosote; then boil until thick. Pour the mass into a dish to cool, when it will resemble soft putty in appearance. This mixture must be stored in a well-corked, air-tight jar, otherwise it soon hardens and becomes useless. Dissolve ½ oz. of bicarbonate of soda in 10 oz. of water, and bottle. When required, mix 4 oz. of the paste in 2 oz. of soda solution, and brush smoothly over unused white blotting paper, removing brush-marks with a piece of polished wood, or a strip of paper wrapped around the forefinger, until the surface is perfectly even. When dry, it is ready to receive reversed copies of pictures, which may be first treated either with creosote or copaiba balsam, though best results may be expected from the latter. Rub the back harder than in the previous instance, as a deep black copy is requisite. Then moisten paper with lukewarm water, and use while damp, rubbing the back gently and steadily. The paper must not be too wet, or the paste will peel off the blotting paper, but with a little care several distinct copies can be easily obtained. Some printing inks are almost immovable; a portion may possibly shift and spoil the picture, without transferring more than a faint outline or a few patches. As a rule, heavy-looking black prints give satisfactory results, and those resembling steel engravings give but faint and worthless specimens.

Varnishing Mounted Prints.—Melt some strong gilders' parchment size and coat the prints with it. Next give them a thin, even coat of good paper varnish, applied in a warm room. Pictures treated in this way must, of course, be first mounted on stiff pasteboard or on a canvas stretcher.

Punches

The wood-worker's "punch" is the nail-set described under that heading. The metal-worker uses a variety of punches, but they hardly interest the handyman. However, a length of the thickest piano wire will furnish a number of small punches

should these ever be required. Piercing punches made of piano wire are highly recommended. It sometimes happens that it is difficult to get a piercing punch strong enough for piercing a hole of the same diameter as the thickness of the metal, espec ally if this is unusually tough. A practical worker has tried various kinds and styles of punches, and has now come to the conclusion that a punch made of piano wire is the very best obtainable.

Putty

Black Putty.—A black putty for metal and wood is made by mixing whiting and antimony sulphide, both finely powdered, with soluble glass. It is said that when hard, this putty can be polished with an agate burnisher.

Examining Putty.—The examination of glazing putty should be carried out in the manner explained by J. Cruickshank Smith in the "Decorator." Putty is a material liable to be adulterated. The dry material used in its composition should be pure whiting, but it often contains barytes. This can be tested by separating the oil and adding hydrochloric acid to the dry residue, which should be practically wholly soluble in the acid. A distinct residue indicates the presence of some adulterant, which is most probably barytes. The oil used in putty should be pure linseed oil, but resin and mineral oils are sometimes added. To distinguish these the putty should be worked up in the hand until it is soft and warm; if it is then smelt, the characteristic odour of resin and mineral oil can often be detected. Resin oil communicates a tacky feeling to the putty, while mineral oil causes it to work very short. A portion should also be tested to see how long it takes to dry hard, a point which regulates its value to some extent for glazing purposes.

Glazing Putty.—To make glazing putty, take a ball of whiting, crush it, dry it, and pass it through a sieve of forty-five holes to the inch. Knead it up with raw linseed oil into a stiff paste, leave it for twelve hours, and then well work it up again with the hands and a mallet. A still harder putty can be made by taking one-third by bulk of the whiting away and substituting one-third dry white-lead before adding the oil.

Picture Frame Putty.—Place best gilders' whiting in a jar and press down fairly close; then, with a knife-handle, make a small hole in the middle, pour in melted size, and gradually stir in the whiting until a stiff paste is obtained. The mixing must be thorough, or the putty will be "rotten." It should be perfectly hard in from two to four hours after applying.

Stopping Putty.—A quick-drying putty for stopping, one that can be glass-papered soon after applying, is made by mixing dry white-lead in good quality brown japan, and adding sufficient lamp-black to colour, a few drops of varnish as a binding agent, and a little turpentine. Putty made of pure white-lead with a sufficient quantity of linseed oil and gold-size added to make it workable is an excellent stopping.

Removing Putty from Old Glass.—Take 4 oz. of fuller's-earth, 1 oz. of soft soap, and 1 oz. of pearlash, to which add a little powdered lime. Let it stand till the putty softens, then wash the job thoroughly with soap and water.

Pyrography (*see* Poker-work)

Python Eggs or Pharaoh's Serpents

These names are applied to small pellets which, on applying a light, gradually protrude a long twisted cylinder like a snake. They are composed of sulpho-cyanide of mercury. Mix the bought material to a paste with water, and roll it into balls without any other addition, drying thoroughly. The pellets are highly poisonous, and are not fit playthings for children.

Q

Queen's Metal

This name is given to a fine silver-looking alloy composed of 100 lb. of tin, 8 lb. of regulus of antimony, 1 lb. of bismuth, and 4 lb. of copper.

Quicklime

Limestone is converted into quicklime by the "burning"—that is, by heating it to a very high temperature. The simplest form of lime-kiln is shaped like an egg-cup inside, and is built of common bricks, lined with firebricks; it is usually built on the side of a hill, the bottom of the kiln being provided with an opening and firebars; the top of the kiln is worked from a higher level, and is quite open. A quantity of coal is first placed upon the firebars, and upon this large blocks of limestone are piled until the kiln is full; then smaller stuff is put on the top and the fire lighted. Carbonic acid escapes, leaving quicklime. In about two or three days the kiln will be burnt out; the firebars are taken out, and the lime drawn when cool. Modern lime-kilns are circular or oval, of the Hofmann type, with a central chimney and a number of charging doors; in these kilns the process is continuous. (*See also* Lime.)

Quickmatch

To prepare a quickmatch, take a portion of the loose cotton that is used for common lamp wick and first soak it in a solution of nitre (saltpetre), then wring out. Make a paste of gunpowder, hot water, and gum solution, and in this rub the cotton until it is well covered. Pass the cotton through the tube of a small funnel so as to produce a cylindrical cord of uniform thickness, and hang up in the open air to dry. When nearly dry, coil up the fuse and rub with dry gunpowder. In handling the fuse, care should be taken not to bend it, or its continuity will be broken.

Quicksilver (*see* Mercury)

Quills

Quills are the large feathers from the wings of birds. Those regularly prepared for writing purposes are obtained from the swan, goose, and turkey, crow quills being used for drawing. The parts of a quill consist of an external membrane and an internal pith, the formation of the quill itself being of epidermic tissue. To dress quills free from the internal pith and membrane, the quills are heated in a fire which enables the outer membrane to be scraped off by means of a thick, strong knife, the quill being pressed nearly flat during the operation. It is held for a moment in the fire, which at the same time strengthens and reduces the quill to the proper state of brittleness to admit of its being cut by knife or machine into a pen. A former method of preparing quills, by which toothpicks are still made, is to immerse them for a night in hot water, and to treat them in hot sand the next day.

Cleaning Quills.—Cut off the small tops of the quills, tie them loosely in bundles, and fix them nearly upright in a saucepan of water in which a small piece of alum has been dissolved (use a piece of alum about the size of a walnut to a quart of water). Let them boil slowly until they become clear; if desired, add a little turmeric or a small pinch of saffron to the water, to give them the yellow colour; dry in the sun. Tie paper round the feather part of the quills, to keep them from dust. The quantity of alum may be increased according to the desired degree of brittleness.

Quill Pens

The commonest plan of toughening quill pens is to harden them by heat, a rough-and-ready way being to put them in warm ashes. They may also be baked in a warm oven.

R

Rabbit Skins (*see* Skins)

Rainproofs, Cleaning (*see* Cleaning)

Ranges, Cementing (*see* Boiler *and* Cement)

Rats, Ridding House of

THERE are three methods of getting rid of rats, namely, by poisoning, by trapping, and by employing a professional rat-catcher. A poison made as follows is highly recommended:—Melt some hog's lard in a bottle plunged in water heated to about 150° F. Introduce into it ½ oz. of phosphorus for every 1 lb. of lard, then add 1 pt. of proof spirit or whisky; cork the bottle firmly after the contents have been heated to 150° F., taking it at the same time out of the water, and agitate smartly till the phosphorus becomes uniformly diffused, forming a milky-looking liquid. This liquid, being cooled, will afford a white compound of phosphorus and lard, from which the spirit spontaneously separates, and may be poured off to be used again in a similar mixture, for none of it enters into the combination; the spirit merely serves to comminute the phosphorus and diffuse it in very fine particles through the lard. This compound, on being warmed very gently, may be poured out into a mixture of wheat flour and sugar, incorporated therewith, and then flavoured, if desired, with oil of rhodium; the flavour may be varied with oil of aniseed, etc. This dough is made into pellets and laid in the rat holes. Being luminous in the dark, it attracts the notice of the rats, is readily eaten, and proves fatal. Other recipes are as follows:—Take equal parts of oil of amber and ox-gall, and add to them sufficient oatmeal or flour to form a paste; divide this paste into small balls, and place in the middle of the infested chamber. Surround the balls with vessels of water. The smell of the oil will attract the rats and they will devour the balls, and, becoming intensely thirsty, will drink the water till they die on the spot. Squill (*Scilla maritima*), the root of which is much used in medicine, is also said to be a powerful poison for rats. It is prepared as follows:—One of the bulbs is cut into slices and bruised, then stewed in a pan with fat, which is afterwards strained and poured into plates; these are put in places infested with rats. To prevent dogs and poultry from eating this poisonous compound, it may be placed in a wooden box, about 1 ft. 6 in. long, having a hole at each end. The rat gets in at one end and goes out at the other, after partaking of the food, which soon kills it. The great objection to poisoning is that the rats die under the floors and in inaccessible places, and, putrefaction setting in, causes a very foul odour. A trap is less liable to create a nuisance, but there is no guarantee that any large proportion will be caught. Toasted cheese and other dainty morsels are left about the entrances to the rat holes for a few nights, then for two or three nights empty rat-traps are placed in conjunction with the dainty morsels, and then the traps are baited and no morsels left outside. By

repeating this operation for two or three weeks a large number of rats may be caught. Placing gas tar and chloride of lime in proximity to the rat holes may then drive away those which are not caught. But the most effective way is to employ a professional rat-catcher.

Razors

Sharpening and Setting Razors.—When a new razor is properly set the edge will appear as shown in Fig. 515, the angle being acute, and, for a considerable time, if no

Fig. 515.—Section of Razor Properly Set.

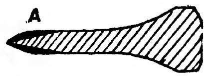


Fig. 516.—Section of Worn Razor.

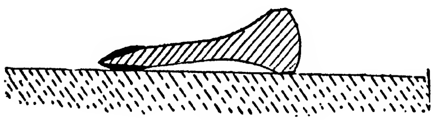


Fig. 517.—Razor on Oilstone.

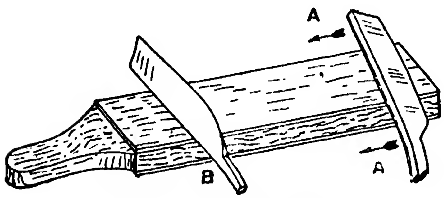


Fig. 518.—Razor on Strop.

accidents occur, stropping every time it is used will be sufficient to keep it in order. After a time, as the cutting edge wears away, the angle becomes more obtuse as shown by Fig. 516, and the leather of the strop will not remove sufficient metal to work the edge to the proper angle. It is therefore necessary to use an oilstone, or, if in bad condition or badly notched, a grindstone first and then the oilstone. A Turkey stone is the best to use for the purpose, as it cuts quickly, and leaves a good edge, but if one of these is not available, a Washita or some other coarse cutting stone may be used first, and the edge finished on a hard stone, such as a Charnley Forest. The use of the stone is to remove the black portion at A (Fig. 516). To do this, the blade is placed on the stone with the back and edge resting as shown at Fig. 517, and rubbed up and down lengthways of the stone, both sides of the blade being rubbed alternately until the waste metal A (Fig. 516) is removed. The sharpening on the oilstone should be discontinued just before the cutting edge is reached, unless the edge is notched, or a wire edge will be the result; that is, a thin edge of metal, that will bend backwards and forwards when the blade is turned over, will be formed. The oilstone should be thoroughly clean, and lard or sweet oil mixed with about a quarter of its bulk of paraffin should be used. The razor is now ready for stropping, and a strap of buff leather, such as an old army belt, is one of the best tools that can be used for this purpose. As a substitute, a piece of fairly hard leather may be glued on to one side of a piece of wood, the surface of the leather being dressed with a little rottenstone and oil, and a piece of soft buff leather may be mounted on the other side of the wood; the dressed surface is used first. In using the strop the blade should be drawn along the leather back first as shown by the arrows A (Fig. 518), then turned over with the back of the blade on the strop as at B (Fig. 518), and not edge downwards, for the return stroke. A few rubs should be sufficient on the soft leather only, the dressed side being used when the razor is in bad condition. Two or three razors should be in use at a time, as it is often found that if given a rest for a week or two a blade that has apparently got out of order will then work better than ever. The strop should be used after shaving as well as before, so as to put the razor away in a good condition.

Reamer

The use of a reamer, says the "Bazaar," is to follow the drill to enlarge and smooth a hole already brought nearly to size. It is not intended to remove much metal. One of its principal advantages comes in when two or more pieces of work have been drilled separately and then brought together to have the holes reamed; for

however carefully the holes were drilled there is sure to be some degree of overlapping.

Reamers, Hardening and Tempering (*see* **Hardening**).

Red-lead

Red-lead is a well-known and largely used red pigment, especially useful in painting ironwork and also in glass manufacture. Its ancient name is minium. It is prepared by oxidising metallic lead in a kind of reverberatory furnace. Red-lead is triplumbic tetroxide (Pb_3O_4). It is a very bright pigment with a slight orange hue. It is heavy, its specific gravity being about 8·6. It has good body and covering power, but is blackened by exposure to air containing sulphuretted hydrogen. It is an active drier. Orange-lead is a form of red-lead—brighter than ordinary red-lead; it is prepared by calcining white-lead. Red-lead is used in jointing pipes, boiler manhole covers, etc., as already described in this book. It is the chief ingredient in a number of cements. Red-lead as ordinarily purchased is composed generally of 20 lb. of the red-lead itself, 5 lb. of oil, and a little driers, and this quantity will be found sufficient for one coat on 750 sq. ft. of iron.

Advantages and Disadvantages of Red-lead.—These are set forth in the "Decorator" by Frank Rathbone as follow:—Among the principal advantages are:—(*a*) It is inexpensive; (*b*) it forms a strong protective covering to the iron or woodwork to which it is applied; (*c*) it is durable, resisting alike the action of frost, damp, and heat; (*d*) it is remarkably adhesive; (*e*) it mixes well with linseed oil; (*f*) it has a powerful drying action on oil, and hence dries quickly; (*g*) it possesses good covering properties, and may be mixed with or applied over any of the other pigments without affecting them or being affected, ultramarine, cadmium yellow, and those pigments which contain sulphur being, however, exceptions. Among the disadvantages of red-lead are: (*a*) It is quite inadmissible as a water paint; (*b*) it is influenced by sulphuretted hydrogen, and turns quite black under its influence; (*c*) it sets quickly; (*d*) it is somewhat difficult to work. The comparison is thus greatly in favour of red-lead, which is worthy of being used to a greater extent than it is in house-painting. The extensive use of it by railway and other companies who have most carefully tested it should be sufficient to demonstrate its value generally.

Resin

Resin or colophony is an oxidation product of turpentine, and is contained in all crude turpentines. The turpentine as it flows from the various species of pine is a viscous yellow fluid very much like honey; if left in contact with air it oxidises and becomes a solid resin. It is, however, taken in the fluid state and distilled, when oil of turpentine or spirit of turpentine passes over and resin is left in the retorts. This is not purified in any way, but is run direct into barrels in which it solidifies, and is shipped in that condition. It is soluble in alcohol and chloroform. It varies in colour from a very pale yellow to a deep brown. Resin consists principally of acids, chief among which is abietic acid. Venice turpentine and Canada balsam are both crude turpentines.

Disguising Smell of Resin.—The smell of resin is persistent, and there is no method of removing it. To disguise it, add some other odoriferous substance in sufficient quantity to overcome the smell of the resin, but without giving a decided odour; try oil of mirbane.

Melting and Casting Resin.—For small blocks tinplate or brass moulds may be used, but for large blocks the moulds may be of galvanised iron sheets bolted together, so that they may be taken to pieces for removal of the blocks when cold. Warm the moulds before the resin is poured in, and, if the blocks are small, the moulds should be kept in a warm place, and allowed to cool slowly, as sudden cooling causes resin to break.

Resin Grease.—A resin grease may be made by dissolving common resin in resin oil; the quantities cannot be given, but try 1 part of resin and 4 parts of resin oil, and if that is not satisfactory, increase

the resin. Heat the resin oil carefully and stir in the resin till dissolved.

Toughening Resin.—Melt it down and stir in some mineral powder such as barytes, china clay, or plaster-of-Paris. The proportions may be varied from one to four parts resin per part of mineral matter; the former yields a mass as hard as slate.

Roasting-jack

Roasting-jacks can be taken apart by undoing the screws or nuts at the bottom. They can be cleaned with benzoline to dissolve the old oil and grease, and afterwards oiled with ordinary machine oil. Stout silk, as used by tailors for buttonholes, etc., is employed to suspend the verge; put on as many thicknesses as convenient.

Rocks, Artificial (*see* Taxidermy)

Roof Repairing

The defects most generally met with in leaky roofs are cracked fillets, caused by vibration; insufficient lap of the roof covering (the lap should increase as the pitch of the roof decreases); irregularity of bond; hollowness of the roof owing to the weakness of the roof timbers; holes in the gutters (generally at the place where they are soldered, or at the angles); and choked gutters and broken slates. When a roof is to be repaired, the leaks should be located by measurements taken inside the house, using one of the walls or a window as a guide. If the source of the leak cannot be discovered in this way, a few slates must be taken off and the search renewed. Another plan is to allow water to trickle down the outside of the roof directly over the suspected place; by removing a few slates where the water has drained off, the weak spot will be plainly seen. It is generally at the angles that fractures occur, and nothing will be found so effectual a preventive as flashings all up the wall, or soakers. If soakers are used, they should be secured to the wall or to battens in order to keep them from slipping down. As a rule, the ordinary fillet cannot be depended on to keep out water; it is badly shaped, being triangular instead of rectangular, and clings to the wall rather than to the roof, the former being rougher and more rigid than the latter. When a fracture occurs (fractures being caused by the vibration to which every roof is subject, and by extremes of temperature), it is always the roof that separates from the fillet, and an opening for the admission of water is formed. Sometimes, especially during storms, water will penetrate a roof though the slates are perfectly sound; this is the result of insufficient lap. If the roof is otherwise in good condition, it will be sufficient to strip a portion about 3 ft. square just over the spot where the water enters, and give an extra lap to the slates or tiles when replacing them. Should it be objected that such partial stripping of the roof will spoil its appearance, a piece of zinc, wide enough to cover the joint or joints where the water finds an inlet, may be inserted between the slates, the zinc being pushed upwards as far as the nails will allow; of course, the zinc must not come down below the bottom edge of the slate so as to be seen. The amount of lap to be given must depend on the pitch of the roof, the nature of the roof covering, and the local peculiarities of the climate. Should the amount of lap vary in the same roof, the largest lap should be given at the bottom, and the least at the top. The bond of the slates can only be kept properly by starting correctly. Slates should be trimmed to a uniform size, and the half slate on the second course, to break the joint, should be exactly half the width of a whole slate. The practice of using small strips of slate for the under eaves, just breaking the joint by about 2 in., and leaving an open space, cannot be too greatly condemned, for it is at this point that the greatest volume of water collects. Such a leak does not often show itself on the ceiling, but soaks into the wall, on which, sooner or later, it makes its presence known by ugly dark patches. The slates at the under eaves should fit as closely as at any other part of the roof. When a roof, owing to faulty construction, has become uneven on the surface, rafters must be fixed up to strengthen and level it. Nothing is gained but much is lost by skimping the roof timbers, for a weak

framework means a strain on the roof covering that necessitates constant repairs. To ascertain the position of a leak on a flat or in a gutter, careful measurements must first be taken inside the rooms, and the gutter must be cleared and washed out and wiped dry. A hole or crack in a zinc gutter shows as a dark line on the surface of the zinc. Fractures in lead are generally not so easily discovered, but they can be found by wiping the surface with a dry rag and watching carefully for the appearance of any damp spots caused by water oozing from the crack. Soldering should be avoided as much as possible. For leaks caused by broken slates and stopped-up gutters the remedy is obvious. Finally, it should be borne in mind that when a leak shows itself on a ceiling the rain does not always enter the roof just above it; very often the water travels some distance along the roof timbers before it finally drops on to the ceiling.

Asphalt for Roof Felt.—Liquid asphalt coating for felt roofing contains 25 per cent. asphaltum, and the balance is coal and water-gas tar. It is of the consistency of hot pitch, and is applied with a large paint-brush. In cold weather oil has to be added to make it flow freely. It is applied to the felt without heating or preparation of any kind, and is effective for from one to two years.

Cement for Roofs (*see* Cement).

Ropes

Grease for Hemp Ropes.—This may be made by melting tallow, running it through a sieve into another vessel, and then mixing with it, constantly stirring, one-fifth part, by weight, of hot linseed-oil varnish. These ingredients must be incorporated thoroughly; then add one-fifteenth part of vaseline. The preparation is applied whilst lukewarm by means of a wooden spatula, and rubbed in with a clean woollen rag.

Preserving Ropes.—When the ropes get wet they should be hung up to dry either in the sun or by artificial means; they should not on any account be placed in a closely confined place, where no air can get to them. Soft soap and tallow would not be of any use after the ropes have been used. Oiled or slightly tarred hemp and manilla should be employed when the ropes are exposed to all weathers. Paraffin wax or shoemakers' heelball may be applied to cotton ropes; blacklead (graphite) is sometimes used, but is not so good, besides adding considerably to the weight. Graphite-oil preservative for manilla rope is used by an American rope manufacturer, who treats the inner yarns of each strand, as well as the core, in a bath of graphite and oil. When the rope is put into service, this lubricant thoroughly permeates the fibre, thus overcoming internal wear,

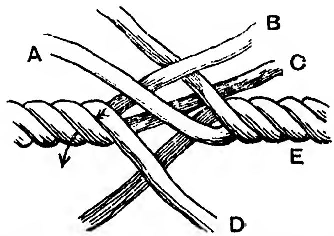


Fig. 519.—Rope Strands placed Alternately.

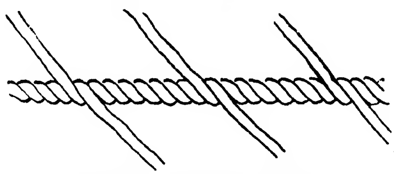


Fig. 520. Long Rope Splice.

while sufficient comes to the surface to afford ample protection outside. The lubricant never leaves the rope. The oil is used as a vehicle to convey the flakes of graphite, and as long as the strands and yarn remain together they are thus kept soft and pliable. Ropes so treated are said to be self-lubricating, and do not need external dressing.

Splicing Cotton Rope.—Unlay the ends to be spliced to the extent of six or seven times the rope's diameter, and place these alternately together as shown in Fig. 519. Push them up close, and grasp in the left hand the three ends B, C, and D, together with that part of the rope marked E, then proceed to tuck the ends; the end A is passed as shown by the arrow. After

making two tucks with each of the three ends, turn the rope round and tuck the other three in the same way; stretch well, and do not cut off too close. If the splice has to go through a block sheave, make a "long splice." Unlay three times as much ends, marry as before, and unlay one strand; follow it up with the end opposite, then unlay another in the opposite direction, following up as before, and the result will be as shown in Fig. 520. Next tie an "overhand" knot with each pair of ends, snug and halve all the ends, and tuck once over one and under two.

Rouge

To prepare jewellers' rouge (peroxide of iron), add an oxalic acid solution to a solution of iron sulphate (copperas) until it ceases to form a precipitate. Filter off the liquid, and wash the residue with repeated changes of water, and then dry. Place in a suitable container, heat gently, and, after it has ignited, allow it to burn until only an impalpable powder is left.

Rugs (*see* Skins)

Rush-seated Chairs (*see* Chairs)

Russian Tallow (*see* Tallow)

Rust

The "Engineer" states that rust is the greatest enemy to all iron structures. An iron surface may be coated with paint, but nevertheless the rusting of the iron proceeds unchecked. Rust is simply a hydroxide of iron or a hydrated oxide—that is, the metallic iron has combined with oxygen in the presence of moisture (water). The brown or brownish-red powder forms on any iron exposed to the atmosphere, and the iron becomes "eaten" or corroded until it is reduced to a skeleton of its former solid mass and capable of being bent or broken as easily as a stick of wood is snapped. Practically speaking, there is no way of stopping the erosive process when once iron has begun to rust, but iron will not rust in dry air or in dry oxygen gas; rust can be formed only when moisture is present. The moisture acts in a catalytic way, conveying oxygen to the iron in such a fashion that the oxygen combines with the metal to form the hydrated oxide. Some authorities assert that rusting can only occur when carbonic acid gas (CO_2) is present in the air or moisture, but it seems clear that the presence of this gas is not essential to the formation of rust. According to the "American Machinist," it has long been stated academically that iron would not rust in pure water or in dry oxygen, but that carbonic acid was necessary to its corrosion. Colour was given to the statement by the well-known corrosion in steam boilers due to air excluded from the feed supply. Mr. Gerald Moody has brought some facts before the Chemical Society relative to this matter. Pure air passed over bright iron wetted with pure water did not cause rust even with exposure for six weeks, but in six hours ordinary air containing its usual 0·0004 part of carbonic acid would cause tarnish, and in seventy-two hours the iron was decidedly red-rusted. Carbonic acid is the element in the air which must be kept from contact with bright surfaces. Some kinds of iron resist the rusting process much better than others; cast iron does not so readily rust as wrought iron, while steel will sometimes resist the rusting for a considerable time compared with iron. The nature of the rust produced also slightly varies, light-brown rust containing a larger percentage of moisture than red-brown rust.

Cleaning Rusty Iron and Steel.—(1) If possible, soak in paraffin oil, and then rub bright with emery powder or emery cloth. Keep in good condition by coating with Russian tallow or vaseline. Turpentine may replace the paraffin. (2) Or, apply sweet oil, letting the article soak if possible; then use emery and finish off with putty powder. (3) After soaking in paraffin any coarse abrasive may be used—coarse sand, etc. A wire scratch-brush is handy too, in removing rust at this stage. (4) Cover the article with sweet oil, well rubbed in, and allow it to stand for, say, two days. Then rub it down with powdered unslaked lime. (5) Another method, with small articles, is to heat them to a dull red, and then plunge them in boiled linseed oil. Next rub with a brush, using oil and emery

powder. The ordinary scratch-brush will do the work more quickly. (6) Rust removers using potassium cyanide are recommended in the directions issued to the U.S.A. artillery. Polished steel instruments may be cleaned as follows:—If possible, soak in a solution of 1 part (by weight) of the cyanide in 4 parts of water, and when all loose rust is removed, polish with cyanide soap, prepared by making a saturated solution of some cyanide, adding precipitated chalk, and then incorporating in a mortar with some white Castile soap cut into fine shavings. Cease to add soap when the mixture gets thick. All preparations containing cyanide of potassium are deadly poisons, and should be used with the greatest care. (7) For removing rust from iron, dip in or wash with a mixture of 1 part nitric acid, 1 part muriatic acid, and 12 parts of water, and then thoroughly rinse with clean water. (8) To clean rusty iron electrically, a very simple method is to bind to it with wire a piece of zinc so that the two are in electrical contact, and then immerse in rather dilute sulphuric acid for several days. The rustier the iron, the stronger should be the acid. If the iron is only slightly rusty, bind round it a length of galvanised wire and then immerse, dispensing with the piece of zinc, that on the wire being sufficient. When all rust is removed, the iron will have a greyish-black appearance and should then be washed and oiled, or treated with a rust preventative.

Quicklime as Rust Preventative.—Quicklime may act in some circumstances as a rust preventative, but it is not recommended. It acts by absorbing moisture, and ultimately, of course, gives up that moisture to the air again. This fact should be borne in mind in considering recipes including quicklime (see, for instance, a paragraph in the next column).

Refining Iron Rust.—Iron rust is a hydrated oxide of iron. It may be converted into metallic iron by heating it with charcoal in a crucible, and finely divided iron thus produced may be picked out with a magnet. It may also be smelted with charcoal and limestone in the same way as an iron ore. Unless there is a large quantity of rust to treat, it will not pay for the trouble.

Rust Joints.—For a slow-setting rust joint on iron use 100 lb. of iron filings or borings to 1 lb. of sal-ammoniac in powder and ½ lb. of flowers of sulphur. This should be mixed to a thick paste with water. For a quick-setting joint, use, say, 80 lb. of iron filings to 1 lb. of sal-ammoniac and about 2 lb. of flowers of sulphur. When a tank has been caulked with a rust joint, the water should not be admitted too soon, especially at any head, as it will wash out the sal-ammoniac before the chemical combination is complete, thus spoiling the joint and causing the tank to leak.

Rust Marks on Linen.—To remove rust from linen, touch the spots with a mixture of 1 part (by weight) of potassium oxalate, 1 part of lemon juice, 1 part of salt, and 16 parts of water. Warm the linen on a hot plate or bottle filled with hot water, and then wash with soap and water.

Rust Prevention.—What is required is to prevent air and moisture from reaching the bright parts of steel machines, etc. For this purpose Russian tallow and oils of various kinds are often used, or the articles may be protected by dressing with boiled linseed oil thickened with a suitable pigment to give it body (so forming oil paint). Rust in powder is often used as a pigment for iron and steel articles. Another method is to add about 2 pints of water to ½ lb. of quicklime, and the mixture should be left till quite clear. Next olive oil is added till it forms a thick cream. The articles to be protected should then be coated rather thickly with this compound. Or quicklime is slaked in a covered pot with enough water to make it crumble, and made hot. Tallow is then added to form a paste, which is wiped over the bright parts. This last preparation can be easily removed. Chief among methods of preserving iron from rust, distinct from mechanical coverings, Prof. John M. Thomson mentions the transforming of a part of its surface substance into an insoluble coating, and the introduction of preservative material a little distance into its pores. Heated to 156° C. and plunged into a bath of pitch and "oil,"

kept at 100° C., some of the mixture appears to soak in and then serves to prevent rust. Barffing consists in heating iron to the proper temperature in a muffle, and blowing a stream of steam at 540° C. into the muffle and upon the iron, forming there, in the course of from six to eighteen hours, a coating of magnetic oxide that does not rust. Bower's process brings about the same end by quicker means, by heating the iron in a brick kiln in the presence of combustible gases, and more air than is needed for their combustion; this results in the formation of a red oxide on the surface. This is then reduced to magnetic oxide by decreasing the excessive supply of air. Many methods of treating iron to prevent corrosion have been adopted, and the following appears to form the best and most durable protection for iron pipes, etc., against atmospheric influences. The iron pipes are first cleaned by means of benzine or turpentine to remove rust, and are then heated over a fire to about 200° F., after which they are dipped into the following preparation: Coal tar 30 gal., air-slaked lime 40 lb., and coal-tar naphtha 2 gal., mixed well together. Ordinary coal tar is injurious to the metal as it contains free acids which attack the iron as stated, but in the above the acids are neutralised. The addition of the naphtha makes the coal tar fluid, and, assisted by heat, the tar readily enters the pores of the metal, which is thus rendered rust-proof. To keep machinery from rusting, a compound is made with 1 oz. of camphor dissolved in 1 lb. of melted lard; the scum is taken off, and as much fine blacklead is mixed in as will give it an iron colour. Clean the machinery and smear it with this mixture. After twenty-four hours rub clean with a soft linen cloth. One good application is said to last for months in ordinary circumstances.

Rusty Bath (*see* Bath).

Rusty Boilers (*see* Boilers).

Rusty Furnace Pan.—These pans should never be allowed to get rusty, for, if thoroughly dried directly after use, they will keep in excellent condition for a month, and in some cases for three or four months. From a fortnight to one month, as a rule, is the longest period that these pans are out of use. For removing the rust, use soft soap and silver-sand, with a little water, and thoroughly scour the pan with this on a coarse cloth, or with a stiff brush. When the rust has disappeared, thoroughly dry the surface. It should then keep good until the pan is next wanted for use; that is, for any reasonable period. Of course, the trouble could be overcome by having the pan galvanised, but even then careful drying would be just as necessary after a time, as the galvanised (zinc) surface soon wears off if the pan is in regular use.

Rusty Range Boiler.—Empty the boiler and well scrub it out. When dry, give it a coat of limewhite well rubbed in. When this is dry, give it another. On this drying, the water can be run in again. The limewhite is made by mixing ordinary slaked lime with water to the consistency of thin cream, a little size being melted and mixed in to act as a fixative. Lime opposes the rusting process, and this is why iron pipes and boilers are not seriously rusted in hard-water districts, the water having lime in solution. Limewhiting the interior of the boiler will not spoil the water in any way, and, being white, it enables anyone to see when the boiler becomes dirty and needs cleaning.

S

Saccharin and its Detection

SACCHARIN is extensively used by manufacturers of prepared foods and drinks as a substitute for sugar, than which it is many hundreds of times sweeter. Chemically, it is a very complex substance and is known as benzoyl-sulphimide. It is a white crystalline solid, which is only slightly soluble in cold water. It is odourless. Apparently, it is not harmful to the human system. It is detected and extracted by means of chloroform. In the case of solid and semi-solid foods, the sample must, of course, be prepared by extraction with water. The residue left after the evaporation of the chloroform, if a considerable amount of saccharin is present, has a distinctly sweet taste. The only other substance—sugar—having a sweet taste which may be present in foods is not soluble in chloroform, and therefore does not interfere with this reaction. Certain other bodies (tannins) which have an astringent taste are present, and as they are soluble in chloroform may sometimes mask the test for saccharin, but with practice this difficulty is obviated.

Sacks

Dressing for Coal Sacks.—There are several methods of waterproofing coal bags. (1) A cheap way is to immerse them first in 20 per cent. of soap in water; then in 20 per cent. of sulphate of copper in water; afterwards give them a good rinsing. (2) Take 12 gal. of linseed oil, 1 lb. of litharge, 14 oz. of umber, and 1 lb. of vegetable black. Boil together for twenty-four hours. This composition should be well rubbed in with a tar brush. (3) Mix together 1 pt. of raw linseed oil, 1 pt. of boiled linseed oil, and ½ lb. of lampblack. Apply two coats of this by means of a paint brush, allowing each coat to dry thoroughly by hanging the bags on a line suspended in a warm room. Raw linseed oil alone takes much longer to dry than the above, but is more plastic and pliable. These processes render the bags impervious to moisture and decay.

Saddlers' Wax (*see* Wax)

Sal-ammoniac

There are many uses for this substance in the arts. It is ammonium chloride—muriate of ammonia—and has a sharp, acrid taste. Sal-ammoniac will dissolve in about two and three-quarter times its bulk of cold water or in a smaller proportion of hot water.

Salicylic Acid, Detecting

The detection of salicylic acid is carried out in the following way:—Solid and semi-solid foods, such as jelly, should be dissolved, when soluble, in sufficient water to make them thinly liquid. Foods containing insoluble matter, such as jam, marmalade, and sausage, may be macerated with water and strained through a piece of white cotton cloth. The maceration may be performed by rubbing in a teacup or other convenient vessel with a heavy spoon. Salicylic acid is used for preserving fruit products of all kinds, including beverages. It is frequently sold as fruit acid. It may be detected as follows:—Between 2 oz. and 3 oz. of the liquid obtained from fruit products, as described above, are

placed in a 5-oz. narrow bottle; then about a quarter teaspoonful of cream of tartar (or, better, a few drops of sulphuric acid) is added, the mixture shaken for two or three minutes, and filtered into a second small bottle. Three or four tablespoonsful of chloroform are added to the clear liquid in the second bottle, and the liquids mixed by a somewhat vigorous rotary motion, poured into an ordinary glass tumbler, and allowed to stand till the chloroform settles out in the bottom. Shaking is avoided, as it causes an emulsion which is difficult to break up. As much as possible of the chloroform layer (which now contains the salicylic acid) is removed

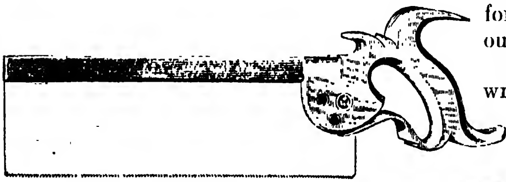


Fig. 522.—Tenon Saw.

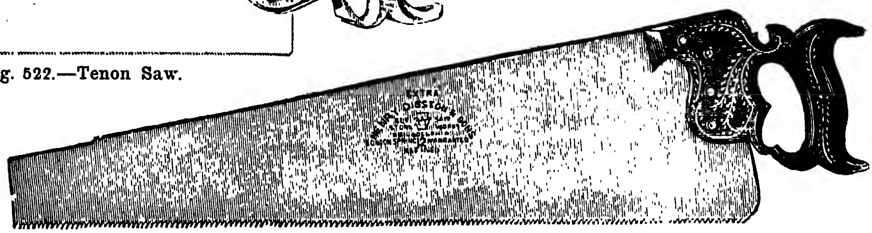


Fig. 521.—Hand Saw with Nibbed Back.

(without any admixture of the aqueous liquid) by means of a medicine dropper, and placed in a test tube or small bottle with about an equal amount of water and a small fragment—a little larger than a pinhead—of iron alum. The mixture is thoroughly shaken and allowed to stand till the chloroform again settles to the bottom. The presence of salicylic acid is then indicated by the purple colour of the upper layer of liquid.

Salt, Glauber's (*see* Soda)

Salt, Spirit of (*see* Acid, Hydrochloric)

Sand Bath

Work has often to be heated on a sand bath. This is simply prepared as follows: Cover a shallow iron pan (a frying-pan, for instance) to the depth of about half an inch with clean, dry sand, and heat it by means of a gas ring-burner. In large laboratories the sand bath is a large iron plate laid in brickwork, covered with sand, and heated by coke burning in a small fireplace beneath.

Sash Cords (*see* Window)

Satin, Gilding on (*see* Gilding)

Saucepans

Cleaning Iron Saucepans.—To clean rusty saucepans, use a wire brush, some sharp sand and water, and brush them until the rust disappears and the iron is clean. Saucepans may be kept clean by dissolving some washing soda in the water that is used for washing them with, and drying them out on the hob before putting them away.

Repairing Iron Saucepan.—To repair a wrought-iron saucepan which has a hole in the bottom, first thoroughly cleanse the iron around the hole by scraping, and afterwards finish with emery cloth; then "tin" the cleansed part with a heated copper-bit and ordinary tinman's solder, using strong chloride of zinc as a flux; then cut out a piece of new tinned iron a little larger than the hole, and place it over it so that its edges lap on to the freshly tinned part. Now solder round the patch, using the solder and flux mentioned above.

Saws and Sawing

The handyman needs at least two saws for wood—one being a hand-saw (Fig. 521) and the other a tenon saw (Fig. 522). The typical hand-saw has a blade which is from 24 in. to 28 in. long, the blade being as thin as possible, but sufficiently strong not to buckle under thrust. The

teeth are bent to right and left alternately, this being called the "set." For general work about the house and an occasional job of firewood cutting, the set should be medium. A fine set leaves a clean cut, but makes the sawing hard work when the wood is thick or damp. The teeth are so sharpened that their points first enter the wood, the fibre being then divided by a gradually incisive kind of action. Six teeth to the inch is a suitable number for a hand-saw. When a saw is required entirely for light carpentry work, a panel saw is to be preferred; this is about 2 in. or 3 in. shorter than the hand-saw, narrower, thinner and lighter. The tenon-saw produces a clean cut owing to the fineness of its teeth, and by its means delicate work can be cut without fear of tearing up the grain. There is a variety of saws used for wood, but the above-named are sufficient for most purposes about a house. For sawing metal, a hack-saw is used, this being a narrow saw held in tension in a frame.

Brazing Band Saws (*see* Brazing).

Sawing.—A common fault with beginners is that they do not take sufficient care at the commencement of the cut or kerf. The first part of a cut is most important, because if that is not made square through the wood it is afterwards a very difficult matter to get the cut square without twisting the saw, and perhaps spoiling it. Begin sawing by placing the left thumb (*see* Fig. 523) or forefinger to the line, so as to guide the saw at the commencement of the kerf, then take a few gentle and careful strokes, making sure that the saw enters the wood at right angles. Move the left hand to a more secure position, and then use nearly the whole length of the saw, taking care not to draw it right out of the kerf, or it may be damaged by striking against the work at the return stroke. See that each stroke is regular. Allow a slight pause between each stroke to enable the worker to retain energy for each downward (working) stroke. Short, jerky and quick strokes must be avoided, for they rapidly produce fatigue, and result in bad work. Do not force the saw: that is, do not press too hard at each downward stroke, as this fault not only leads to fatigue, but also strains the saw. When accuracy is important, occasionally test the saw in the cut with a square to see whether it is perpendicular to the surface of the wood (*see* Fig. 524). As far as practicable, the saw-blade, marked line, and saw-cut, the eyes, shoulder, elbow, and hand, should be in one plane. The head should be over the saw, so that the operator is able to see that the saw-blade is out of winding with, and in the same plane as, the line; this is a very important point. A faulty position for hand-sawing is to have the head not over the saw, but some distance to the left of it; consequently,

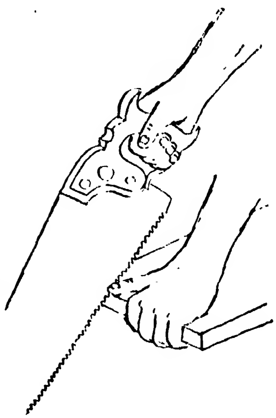


Fig. 523.—Beginning Saw Cut.

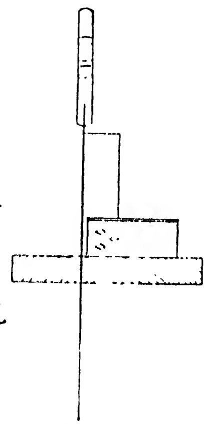


Fig. 524.—Testing Perpendicularity of Saw Cut.

the saw leans to the left, and cuts out of the perpendicular. This fault is usually combined with another, namely, getting too far behind the tool, which attitude does not allow the operator to compare the saw with the line, because he is not able to keep his head over it, and he is also prevented from having full command over the saw. By holding the saw in a more vertical position, there are fewer teeth in contact with the wood at one time, and hence there is less resistance than when the saw is made to slant more nearly to the horizontal; the defect noted is that known as "laying" the saw. With thick stuff it is a good plan to square the lines

down each end and line out each side, and then, during the process of sawing, to turn the wood over occasionally, and thus saw from both sides. When, however, it is desired to saw the wood entirely from one side, the blade should be tested now and again with a square, to see whether the saw is at right angles to the surface of the wood (*see* Fig. 524). After sawing down a foot or two, it will be found desirable to open the cut a little by inserting a screw-driver or wedge, so as to reduce the friction between the sides of the kerf and the saw-blade. Do not open the saw-kerf wide, as this tends to split the wood, and to cause the

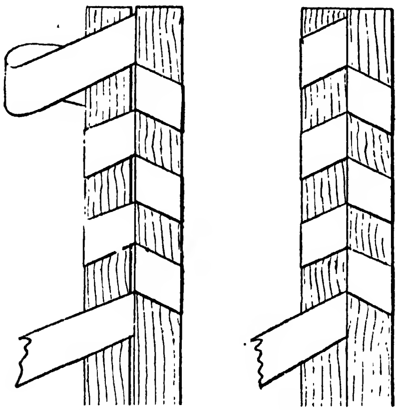


Fig. 525. Fig. 526.

Figs. 525 and 526.—Hingeing Screen Frames.

saw to wobble, thus increasing the difficulty of following the line. It is desirable to lubricate the blade with a little oil.

Sawing Wet Wood.—In attempting to saw a piece of wet plank with a hand-saw, great labour and difficulty will be met, and the difficulty will be much increased if the cut is made across the grain—that is, transversely to the direction of the fibres. If the stuff is very thick, the saw-blade will stick fast in its kerf. There are two reasons why the saw sticks in soft wet wood. One is that the kerf is not wide enough, and the other that the saw-dust cannot get away quickly enough. Hence the remedy is to increase the set and to enlarge the spacing of the saw-teeth, which means an increase of the space between the centres of the teeth, with a consequent increase in the sizes of the teeth themselves. In attempting to use the same saw on thin and hard wood, trouble of another kind will be met. The teeth will catch in the wood, the saw will sway too closely and freely in the kerf, and, if cut across the grain, the timber will become broken or spalted out.

Scenting Paper

Notepaper and stationery may be scented by liberally sprinkling two sheets of thick white blotting paper with perfume, then putting it between clean foolscap paper, and placing it to dry under pressure or under a heavy weight of books. When quite dry, put the notepaper and envelopes between the sheets, replace the whole beneath the weight, and allow it to remain a day or so. The "Bazaar" recommends keeping the scented paper in a box, as otherwise the scent will become much fainter.

Screens

When screen frames are completed, it is often a difficult matter to decide which is the best and cheapest way of hanging or hingeing them. A screen should be hung so that it will close both ways, but the expense of the double folding joints made specially for that purpose is too great to admit of their frequent use. The following description gives a cheap and efficient substitute of a very simple character. Assuming that the frames are ready for hanging, and that the screen consists of four frames, there will be three separate hangings, which will require six laths laced together in pairs, as shown. The laths should be sawn out of a $\frac{1}{2}$-in. board the full height of the frames, and if the thickness of them is $\frac{7}{8}$ in., the laths should be $\frac{1}{16}$ in. wider, to allow the screen to close flat together without any strain. Gauge and plane up the laths both in width and thickness, neatly finish off the ends so that all of them are exactly the same length, and, to prevent the sharp edges cutting the tapes, rub them well off with glasspaper. They are now ready for either painting, staining, varnishing, or polishing, as choice directs. When they are dry, proceed to put on the

tape, which may be got in various colours from ¾ in. to 1 in. wide; about 3 yd. will be required for each pair of laths. Mattress binding is good for the purpose; being made of linen, it does not stretch. Begin by tacking the end of the tape to the top end and underside of one of the laths in an oblique direction; lay the two laths together, pass the tape up between them from the underside, and lace them together rather loosely, over and under, first left, then right, and leaving a loop as shown at Fig. 525. When sufficient turns have been put on to reach the bottom, begin at the top to pull the laths tight together (Fig. 526), turn by turn, and regulate the distances; fasten the end off at the bottom to the underside, as before. It is of great advantage to hold the two laths in the bench-screw edge to edge while pulling the tape tight, as it leaves both hands at liberty to manipulate it. Proceed now to hang the frames together; bore four holes in each lath, at equal distances between the tapes, neatly countersink for screw-heads, and, with brass screws (for neatness), screw them to the edges of the frames. This joint has a very pleasing effect if it is neatly done and if the tape harmonises with the material on the frames. It is very durable, draught- and sight-proof, and can, if necessary, be renewed at a very small cost of time and money.

Screwdrivers

A screwdriver for general work should be of medium length. The London screwdriver, shown by Fig. 527, and the cabinet screwdriver, shown by Fig. 528, are the principal patterns. Speaking generally, the oval handle entails less strain on the hand; it can be had with either style of blade. A gimlet-handled screwdriver (Fig. 529) has certain advantages and should be more generally known; it is much more powerful than any other small screwdriver.

Substitute for Screwdriver.—A substitute for a pocket screwdriver can be easily made from an old saw-blade. This is cut in such a way that the finished screwdriver will readily fit into the vest pocket, and by making a number of cuts around the circumference of the piece a tool can be produced which will fit in all of the ordinary size screws. A tool of this character is especially useful in taking out the screws of flush tanks, as most of these screws are placed on the back of the lever.

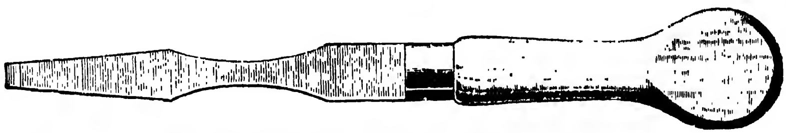


Fig. 527.—London Screwdriver, with Plain Handle.

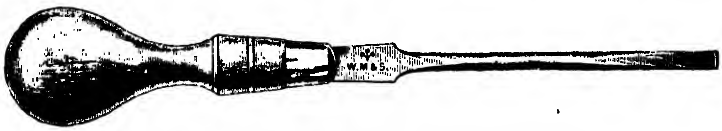


Fig. 528. Cabinet Screwdriver, with Oval Handle.

Screws

Screws for wood are made of steel or brass, and are called "wood screws." Their variety is endless, but the two principal patterns are illustrated by Figs. 530 and 531. The round-headed screws are usually japanned and used for bolts, locks, etc.

Making "Wood Screws."—The blanks are formed of wire, which is drawn into a heading machine, cut off to length, and the head formed by a punch propelled against the heading die. The blanks are placed in the hopper of the machine, and by a mechanical arrangement are withdrawn one by one and placed in the machine where the head is turned. They are then held in grips and nicked by rotating saws,

the burr being removed by subjecting the blank head to the turning tool; one complete revolution of the tool accomplishes the two operations, and the headed and slit blanks drop down into a receiver.

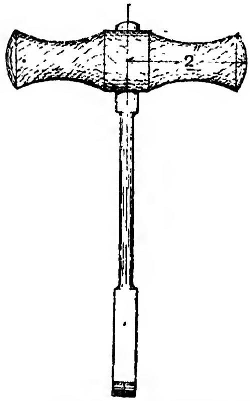


Fig. 529.—Gimlet-handled Screwdriver.

The blanks now pass to the worming machine hopper, and are then taken to the clams; a cutter is next passed along the blank to produce the thread and to form the point. The screw is then released and falls into a provided receptacle. This machinery for screw-making is all automatic, so that one person can attend to a number of machines, as it is only necessary to see that the supply of blanks is continuous in the hoppers, and that the cutters are changed when worn.

Removing Broken Castor Screw.—In the workshops broken screws are quickly bored out with a coring bit and brace. If this is not available, the screw can be removed by placing over it a $\frac{3}{8}$-in. wad punch and hammering down to the depth of the broken screw. The core will generally come out with the punch. Or cut a clean notch in the end of the broken screw; then turn it out with a screwdriver. If it is a 4-in. or 5-in. sofa leg of soft wood such as pine, etc., the screw will punch down out of the way; in any case, after removal fill up the hole before inserting the screw of a fresh castor.

Sealing Wax

Sealing wax is no new material. The Hindoos from time immemorial have possessed lac, and were well accustomed to use it for sealing manuscripts long before it was known in Europe. It was first imported from the East into Venice, and then into Spain, in which country sealing wax became the object of a considerable commerce to other countries under the name of Spanish wax. If shellac be made into sealing wax immediately after it has been separated by fusion from the palest qualities of stick or seed lac, it forms a better and less brittle article than when the shellac is fused a second time. Hence, sealing wax prepared in the East Indies deserves a preference over what can be made in other countries where the lac is not indigenous. Shellac can be restored in some degree, however, to a plastic and tenacious state by melting it with a very small portion of gum or paraffin wax. The palest shellac should be selected for bright-coloured sealing wax, the dark kind being reserved for black. The best kinds of sealing wax are composed largely of shellac, while the commoner kinds, such as bottle and parcel wax, contain a large quantity of common

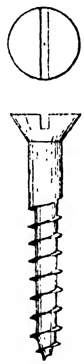


Fig. 530.

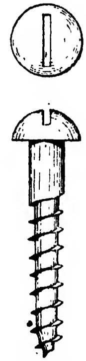


Fig. 531.

Figs. 530 and 531.–Two Kinds of "Wood Screws."

resin. Best red sealing wax may be made by melting together 1 lb. of shellac, $\frac{3}{4}$ lb. of Venice turpentine, 13 oz. of vermilion, and $4\frac{1}{2}$ oz. of magnesia. Black sealing wax may be made from 1 lb. of shellac, $\frac{3}{4}$ lb.

of Venice turpentine, ¾ lb. of resin, 3 oz. of chalk, 2 oz. of gypsum, and 7 oz. of vine black. Red parcel wax may be made from 3 oz. of shellac, 1 lb. of resin, ¾ lb. of Venice turpentine, 1 oz. of oil of turpentine, 6 oz. of chalk, ½ lb. of gypsum, and ¾ lb. of minium. The materials are melted together in an iron pot, and stirred thoroughly until they are amalgamated; the mixture is then poured into the moulds which are made of brass with grooves for moulding the sticks. When the sticks are solid they are removed from the moulds and placed on an iron plate, which is kept gently heated; and when the wax becomes slightly softened the name is printed on with small metal type fitted in a small holder. To render sealing wax less inflammable, barytes (barium sulphate) may be added.

Sealing Wax Varnish.—Sealing wax used as a pigment is dissolved in spirits of wine. It is then specially suitable for plastic work, the background being put in with oil-colour paint, and the lights being added with the sealing-wax paint; this really is a coloured varnish. Different shades are produced by diluting the paint, but the gradations of tone cannot be obtained so accurately as with oil-colour. Surfaces coated with sealing wax require to be protected from stove heat and from the rays of the sun; this is obvious when the nature of the wax is considered. Such surfaces should be protected with a coat of dammar varnish, which prevents cracking.

Sealskin (*see* Skins)

Seaweed

Bleaching and Cleaning Seaweed.—(1) Well wash in many changes of fresh water, and, after well shaking, hang up to dry. Bleaching, by means of chemical agents, in most cases has a tendency to render seaweeds brittle. The safest method is to expose them to the action of sun and air. (2) Wash carefully in warm water containing about 2 oz. of washing soda to 1 pt., then pass through clean cold water and hang up to dry. For bleaching, allow them to soak for about half an hour in a solution of permanganate of potash (1 oz. to 1 pt.), remove, and soak again in dilute hydrochloric acid (1 part of acid to 10 parts of water); remove, and thoroughly wash for an hour in running water, then dry. (3) Soak the seaweed in water for twenty-four hours to soften it and to extract the salt, next steep in a solution of 1 part of bisulphite of soda in 10 parts of water for twelve hours, then add 1 part of sulphuric acid previously diluted with 5 parts of water, and allow to remain a few hours longer. Remove the seaweed and steep in water, which should be changed several times, then dry slowly.

Dissolving Seaweed.—Some varieties of seaweed, for instance, Irish moss, Iceland moss, and a few other kinds, can be dissolved by boiling with water into a glutinous liquid, which, on cooling, sets to a stiff jelly. Other seaweeds do not form a gummy liquid, and are but little altered by boiling with water. If, however, carbonate of soda or caustic soda be added to the water, many of the seaweeds can be made into a glutinous mass.

Dyeing Seaweed.—In all cases the salts must first be removed by washing in many waters. After this, many kinds simply require drying and finally varnishing. Most of the red seaweeds quickly lose their colours, but the tints are easiest and best restored with oil paints well thinned with turps. However, if dyes must be used, the weed should be freed from salt as above, then washed in clean soap and water, or in weak ammonia water, and afterwards given a prolonged soaking in hot dye. In some cases it may be advisable to boil for a time in the dye. The final wash in clean water is in most cases better dispensed with. Then they may be hung up to dry in the shade after being well shaken.

Seltzogene

The seltzogene consists of two glass bulbs, direct communication being prevented by the neck of the lower bulb projecting to about the centre of the upper bulb. The latter has a metal cap at the top with an inside screw, and into this the metal cock is screwed. This cock consists of a lever acting upon a valve, which opens or closes communication between the bent

metal tube at the side and the inner narrow glass tube which penetrates to the bottom of the lower globe. There is usually no other opening to the bottle than the bent metal tube for ejecting the contents.

Charging Seltzogene.—The following materials will be required. An ordinary tinplate funnel, a funnel with a tube not more than 1 in. long and about 1 in. diameter, and a piece of wire with a tinplate cone about ¾ in. diameter soldered near one end. Wash the seltzogene thoroughly, place it in an inverted position in a warm place, and allow to drain for several hours. Then place the tinplate funnel in (the tube of the funnel should project into the neck of the lower bulb), nearly fill the lower

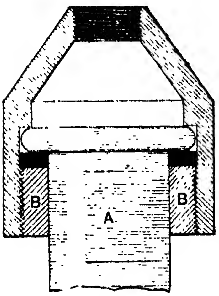


Fig. 532.

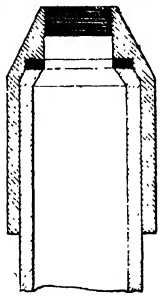


Fig. 533.

Figs. 532 and 533.—Fixing Collars on Glass Seltzogenes.

bulb with good soft drinking water to which a few grains of bicarbonate of soda have been added, and withdraw the funnel. Now place the wide funnel in, and also the tinplate cone, allowing it to rest on the neck of the lower bulb, and thus close it. Next shake in the charge for the seltzogene (a mixture of bicarbonate of soda with tartaric acid or bisulphide of soda, obtainable from any chemist)—the dry powder will go into the upper bulb; withdraw the cone and funnel. Now screw the cork on tightly, and incline the seltzogene a little so that some of the water passes into the upper bulb. Effervescence will begin, and the seltzogene may then be stood upright again. After a few minutes, draw off about a wineglassful of the water. Allow the seltzogene to stand two or three hours; the water will then have become fully charged with gas, and may be drawn off as required.

Fixing Collars on Glass Seltzogenes.—There are several methods of fixing the tops on seltzogenes. When a solid glass collar is run on the neck of the bottle A (Fig. 532), the best way of fastening the metal top is to have a ring B, about ¼ in. thick, hinged in the centre so that the ring can be made to clasp the neck below the collar: on this ring a thread is cut, by which the metal top is screwed down tight, a rubber washer (shown black) being placed between the top of the bottle and the metal. The illustration (Fig. 532) clearly shows this. Many of the seltzogenes have a plain neck, and in this case the metal top is either made to fit tight, and is forced on with a washer between the meal and the neck of the bottle (Fig. 533), or is cemented on with plaster-of-Paris, Keene's cement, or, better still, with Canada balsam cement.

Leaky Seltzogene.—Perhaps the best cement for stopping a leak in the neck of a seltzogene is that used for solid perambulator tyres. The cement must be melted and the glass top and metal cap of the seltzogene warmed very carefully before the fire or the glass will crack; both glass and metal must be perfectly dry before applying the cement. Other cements are a mixture of 4 parts of shellac and 1 part of Venice turpentine; and white of egg made to a paste with finely powdered quicklime.

Removing Metal Tops from Seltzogenes.—The metal tops of seltzogenes are made to unscrew with the hand, but if they have not been removed for some time and are stuck, cover the jaws of a vice with two pieces of thick sheet-lead, and use this to grip the tops, when they will easily unscrew.

Shelf Fixing

Suppose that a shelf has to be fixed into a recess. First take the angle of one end of the recess. This can be done with a two-foot rule, opening it to fit the angle (*see* Fig. 534), and marking the same on the board. Measure the length of the recess, and mark the same on the back edge of the board. Take the angle of the other

corner of the recess as the first was done, and mark in like manner on the board, as before. If the board is now cut to the lines, it will fit. To avoid any disappointment which might arise from imperfect plastering, rendering the angle uncertain, it would be better to decide the height, and fix a ledge or bearer of wood to the wall. These bearers of 1-in. wood, in winding. The hole may be slightly undercut, and the plug driven in with a hammer. When driven sufficiently, no more blows must be administered, for when the plug will not go further, additional blows only tend to loosen it. The projecting part of the plug must be cut off with a saw, taking great care to avoid spoiling the wall surface beyond that which the bearer covers. In

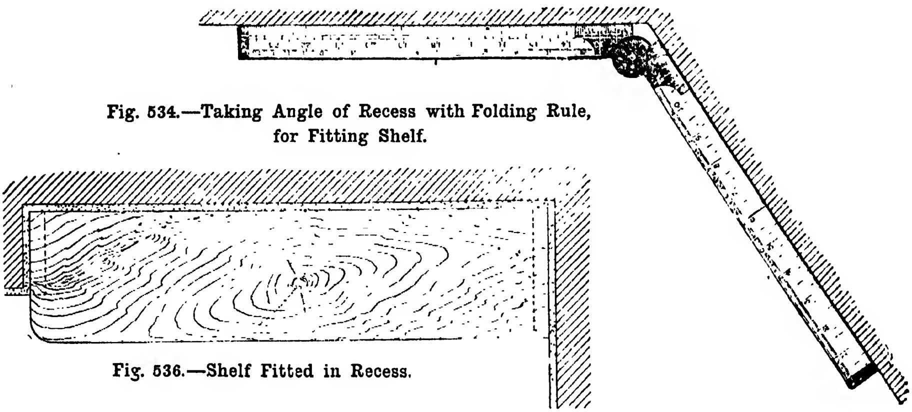


Fig. 534.—Taking Angle of Recess with Folding Rule, for Fitting Shelf.

Fig. 536.—Shelf Fitted in Recess.

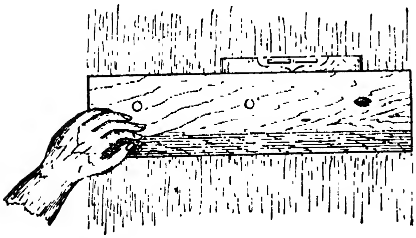


Fig. 535.—Getting Shelf Bearer Horizontal.

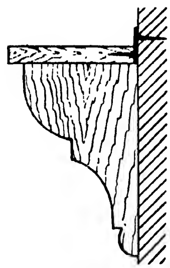


Fig. 537.—Side Elevation of Shelf Supported on Brackets

about 3 in. wide, and length according to the width of the shelf, are usually nailed to the wall—if it is a wall, and not a lath-and-plaster partition. There is some risk of failure, which cannot be avoided. The nail may come in contact with a very hard brick, and refuse to be driven. In that case, either drill or chisel with a small cold chisel a hole in the wall, cutting it deep enough to hold a plug—say, at least 2 in. Then cut a piece of deal about the right size, but taking care to chisel it somewhat most instances, however, it will be found that a good nail, straight and stout, will go into most brickwork that has been plastered over; but avoid slender nails, and bore holes in the bearers for the nails, for it is essential that the nail should hold more tightly in the brickwork than in the wood. But it may be that the wall (in appearance) is but a lath-and-plaster partition. Then the position of the upright timbers must be ascertained, and the bearer screwed or nailed to them. By all means use screws if

possible. To find out where the timbers are, tap with the knuckles or very gently with a hammer. The difference of feeling and of the noise will soon indicate the position. Do not strike hard, or a rattling noise will indicate that the "key" or overhanging plaster is being knocked off the inner surface of the laths. When one nail or screw is inserted in one of the bearers, test with a spirit-level (*see* Fig. 535). When satisfactory, put in the rest of the nails or screws; then put the shelf in. If properly cut, it will almost support itself. If loose, get a helper to hold it at the free end, or prop it up; test with spirit-level, and mark for the other bearer, if necessary. Remove the shelf, but if it fits rather tightly, avoid doing so, as it will most likely damage the wall. If the ledges have been cut wide enough, they can be fixed without the removal of the shelf. One other difficulty may occur—the partition may be covered with patent plastering, in which case it will be difficult to tell where the timbers are. But there is this compensation: that screws will hold fairly well in the plaster itself, independent of the timbers. Fig. 536 shows a shelf fitted in a recess. When the shelf is wider than the recess is deep, always round off the projecting corner, as shown, to avoid things being caught or knocked against it. When a shelf has to be put up on the face of a wall not in a recess, brackets of wood or iron must be used; if of wood, the end view is as shown in Fig. 537, and both shelf and brackets can have "glass" plates screwed to them, by means of which they can be nailed or screwed on the wall. Simple iron brackets are cheap, and have holes for nails or screws.

Shellac

Shellac is the gum product of insect life abounding in India and Asia. The bulk of supplies comes from the former country, though the Siamese lac is by many regarded as the best. It is a resinous substance found in the form of a crust surrounding the twigs or extreme branches of trees, and is believed by some to be the exudation of the bark following as the after-effects of a puncture made by the insect *Coccus ficus* or *Lacca*. It is asserted by those who have made a study of the subject that lac is formed by the exudation from the bodies of the insects which collect in vast numbers on the twigs. Be this as it may, the value of the lac or gum depends chiefly on the brightness of the colour and the thickness of this incrustation, which is sometimes ½ in. On the after-treatment of this gum for commercial purposes depend the various grades or qualities—hence the fact that there is seed lac, orange shellac, dark and pale, garnet, button, and bleached shellac.

Bleached or White Shellac.—This is used for polishing and varnishing transparent work, such as marquetry, transfers, and light-coloured woods—as sycamore, chestnut, holly, and maple—and in the finishing stages of best black work. It is made by steeping and boiling ordinary shellac in a strong solution of common washing soda, and afterwards washing in a dilute solution of sulphuric acid. It is usually sold in the form of white twisted rods of about 1 in. in thickness, three or four of these being matted together, and, unlike other shellacs, is kept under water when not in use. Before dissolving in spirit, it is necessary that it should be broken into fragments—the smaller the better—in fact, it should all pass through a sieve of ½-in. mesh. It should then be spread out on clean paper and set aside in a moderately hot, clean room for at least a day to dry. Thus treated, it will readily dissolve in methylated spirit if set aside in a warm place and frequently stirred up.

Button Shellac.—This derives its name from its resemblance to large buttons instead of being in the form of thin, crinkled sheets or flakes, like the orange lac.

Dissolving Shellac.—Shellac is dissolved by breaking up fairly fine, drying, and then steeping in methylated spirit, spirit of wine, or ether. It is partially soluble in turpentine. A solution of shellac in methylated spirit forms shellac knotting or common shellac varnish.

Garnet Shellac.—This is very dark in colour, and usually forms the foundation of cheap black work.

Orange Shellac.—This variety, whether dark or pale in colour, is that most largely

used by the french polisher, the darker coloured or cheaper quality—which, by the way, often has most body in it—being used for common work. The paler in colour, sometimes called lemon shellac, is used for the better class of work which it is desired shall stand out clear without any colouring substance.

Seed Lac.—Seed lac is largely used in the manufacture of lacquer and spirit varnish, owing to its non-colouring qualities, and forms part of the early stages of the lac during the process of refining.

Shellac Water Varnish.—Shellac water varnishes may be utilised for a variety of purposes. They are much cheaper than the shellac spirit varnishes, and may be applied more evenly. They may be employed as a hat polish, for polishing boots and shoes, for dry-plate negatives in photography, and for wicker or basket work. The varnish may easily be prepared by placing 12 oz. of shellac in $\frac{1}{2}$ gal. of water, boiling, and adding 2 oz. of borax and $\frac{1}{8}$ oz. of glycerine. Mix thoroughly, and strain through muslin. It may be tinted to any colour by adding suitable dyes soluble in water. For boots and shoes use logwood or nigrosine; for blue, alkaline or methylene blue; for reds, eosine or magenta; for greens, brilliant or malachite green; for violet, methyl violet. This preparation dries almost immediately, and the addition of glycerine imparts elasticity to the varnish. It is also waterproof, and may be used as a stencilling or marking ink for boxes, bags, etc.

Shells

Cleaning and Polishing Shells.—Shells to be preserved and polished may be roughly divided into three classes:—(*a*) Shells having a natural polish, or requiring very little preparation; (*b*) those which have no natural polish, but which may be polished without much trouble; (*c*) rough shells, requiring their roughness to be removed by mechanical means before they can be polished. Shells in the first class need very little attention, especially those found in a natural state with a glossy surface, and often of very beautiful variegated hues. Simply cleaning will answer with some of these; with others the colours and polish will not be so bright when dry as in a wet state, but the brightness can easily be restored by brushing over them water in which a little gum arabic has been dissolved; or white of an egg or colourless transparent varnish can be used. The last can of course be washed should the shells get dirty. With some, the polish and colours may be obscured by a dull epidermis, or outer skin; this must be removed by soaking in warm water, and rubbing it off with a brush or a rag dipped in common hydrochloric acid, afterwards well washing the shells in water, and proceeding as before. But after removing the dull skin, it will be found that most shells will have no natural polish; these constitute the second class. After removing the skin, wash well in warm water and dry in hot sawdust; then a polish may be induced by simply rubbing with chamois leather, or chamois leather and a little olive-oil. Some will probably require to be smoothed down with emery paper, then rubbed with wash-leather dipped in turpentine and dressed with tripoli powder, then with fine tripoli alone, and finally with olive-oil and chamois leather for the finishing touches. Shells belonging to the third class are the most difficult, and take the longest time to polish; but these will be found to subdivide themselves. Ordinary files, followed by emery cloth, will remove the roughness of some, and they can then be polished in the same way as mentioned for the second class. Others must be ground with wheels of different degrees of fineness, or wooden and other discs dressed with different substances, such as washed emery, rottenstone and water, and leather with putty-powder or tripoli. All rough shells should first be boiled in a strong solution of potash. When grinding some shells, the outer stratum or strata may be ground through, so as to show the underlying ones. Grinding shells is by no means an easy operation, and in some cases it may be positively dangerous to the hands, which may be crippled if the work is much indulged in.

Cleaning Aquarium Shells.—It is impossible to keep delicate shells fresh and

clean at the bottom of an aquarium. The shells may be cleaned by plunging them in a boiling mixture of 1 part of hydrochloric acid to 10 parts of water. Hold the shells with a pair of wooden tongs, plunge them into the boiling mixture, and let them stay there for one second only. Then place them immediately into clean cold water. Repeat the operation if necessary, but if the shells remain in the acid beyond the prescribed time, they will be eaten in holes, if not altogether dissolved. If the shells are to be replaced in the aquarium, it is not worth while to clean them repeatedly. Introduce a few freshwater snails into the aquarium, and they will keep down the green growth.

Shio Liao (*see* Cement, Chinese)

Shoemaker's Ink, Paste, etc. (*see* main headings, "Boots and Shoes," "Ink," "Paste," etc.)

Show Bottles (*see* Bottles)

Silk

Cementing Silk to Paper.—Make a strong glue in the usual way by soaking glue in water and melting it down by heat, then when it is nearly set, apply evenly to the silk and press the paper upon it. Very stiff paste might also be employed. This should be made by boiling about a teacupful of water in a pan, mixing a tablespoonful of flour with two tablespoonsful of water until all lumps are removed, then pouring the boiling water into this while stirring it; after adding the water, the whole is to be poured back into the pan and thoroughly stirred while it is heated, until it forms a very stiff paste. When the paste is cold, it may be applied to the silk with the finger or with a brush, but as little as possible, spread evenly, should be used.

Distinguishing Natural from Artificial Silk.—Natural silk and artificial silk have quite a different composition; the natural silk appears under the microscope to be made up of long, smooth, nearly cylindrical fibres, which have no internal canal or depression like cotton. It is a nitrogenous substance, and when heated shrivels up, giving an odour of burning feathers. It is readily dissolved by a warm solution of caustic soda; with strong nitric acid it forms a yellow jelly; with an ammoniacal solution of oxide of copper it is not dissolved; with strong sulphuric acid and iodine it is not coloured blue. Artificial silk is a nitrated cellulose (in some cases it has been denitrated); under the microscope it appears in long, perfectly cylindrical threads, even more regular than natural silk; when heated it does not shrivel, but burns rapidly, leaving little or no residue; it is not dissolved by a warm solution of caustic soda unless it be very concentrated; it is scarcely affected by strong nitric acid, and is not coloured yellow; it softens and dissolves easily in an ammoniacal solution of copper oxide; with strong sulphuric acid and iodine it swells up and is coloured a deep blue.

Lining Box with Silk.—The following are instructions on lining a box with silk, set up underneath with cotton-wool. To set up the silk lining, procure some best white wadding in sheets. Cut the wadding 1 in. less than the side to be covered, and paste in position skin side down; serve the other side and ends similarly. Dissolve some good glue, allow it to boil, then add an equal quantity of rye-flour paste; let the mixture get nearly cold before using. Cut the silk and allow ½ in. each way for turnings; spread the glue paste on the borders with a stiff brush or palette knife, and gently place the edges of the silk in position. Cover the bottom first, then the sides, and lastly the ends. If the linings are to be quilted, the work must be done on the machine before the linings are placed in position. Cut the silk as previously described, and lay on the wadding; mark the top out in 1½-in. diamonds, and sew the two fabrics together. The borders can be pasted down as before, or a strip of material can be first pasted round the edges, and the silk lining sewn to this on the inside edge. The glue must not be used hot, or it will penetrate through the silk; allow the glue to get to a jelly, and spread it on with a knife, using as little as possible.

Silk Hat Manufacture (*see* Hats).

Silver

"Ageing" Silver.—New silver ware may be made to look old and to acquire an antique appearance by a very simple method. The worn appearance must be produced by hand with suitable tools, such as wood punches for making dents, blunt steel scribers for making scratches, and polishing mops and bobs for wearing off sharp edges. When this has been done, boil the ware in potash solution in order to remove all grease, then dip the pieces one by one whilst hot in a hot solution of potassium sulphide, repeating the dipping until the desired tarnished appearance has been secured. When the pieces are dry, the tarnish may be removed from any particular spot by rubbing with a piece of wash-leather that has been smeared with some polishing composition; then varnish with Zapon or other celluloid varnish. Sulphide of potassium or liver of sulphur is a badly smelling brown salt, and can be obtained from any chemist.

Cleaning Silver.—(1) Tarnish may be removed by soaking the articles in a quart of hot soap-suds, to which has been added 1 oz. of potassium cyanide and ½ oz. of ammonium carbonate. When the silver appears white, rinse it in boiling hot water, and dry in hot boxwood sawdust. This treatment leaves the surface dull if the silver has been much tarnished. (2) This is suitable for chains. Rub well over with rouge powder rubbed up in best sweet oil. Boil off in clean hot water and polish with dry rouge, finishing with ground whitening. (3) Black stains can be removed from silver by the application of aquafortis or dilute nitric acid. This is generally accomplished by dipping. (4) This refers to the cleaning of frosted silver. If access can be had to a polishing lathe fitted with a suitable frosting brush, the silver can be easily cleaned and re-frosted. If badly tarnished, first soak the tarnished parts in liquor ammoniæ, or brush them with a strong, hot lather of curd soap containing ammonia; then rinse in boiling water, and dry, and finish under the frosting brush. If a polishing lathe and brush are not available, use a stout bristle brush, and beat the frosted part with the tips of the bristles dipped in a paste made of prepared chalk and liquor ammoniæ. Beat the silver until the paste has dried and been beaten out again; then rinse in boiling water, and afterwards beat with a dry, clean brush until quite dry. Frosted and polished silver may be kept from tarnishing by lacquering with very thin, transparent celluloid lacquer.

Cleaning Tarnished Silver Lace.—It does not answer to clean common silver lace; all the tarnish cannot be got out from between the laps of the tinsel, and all the cleaning solution cannot be removed from the cotton afterwards, where it lurks, and again hastens subsequent tarnish; some of the silver coat is liable to removal by the action of the cleaning process. Even the best silver lace, made with silver thread, cannot be restored to its original colour by any cleaning process, because the tarnish cannot be removed from the edges of the laps of the silver ribbon wound around the thread. Silver wire lace may, however, be cleaned as follows: Pin the lace to a planed board, and rub it with a small sponge dipped in a solution of cyanide of potassium, made by dissolving 10 gr. of best cyanide in ½ pt. of distilled water. Rub the lace with the wet sponge lengthwise of the wire laps until all the tarnish has been removed, then treat the other side in the same manner. Next well swill the lace in hot water to remove as much of the cyanide as possible, and absorb all excess moisture by pressing the lace between folds of clean white rag. Finally, beat into the lace with a moderately hard brush enough prepared chalk or whiting to brighten the surface and dry it, and complete the drying on a hot plate.

Frosting Silver.—A large number of silver articles are given a frosted appearance by holding them under a sand blast. A stream of sharp-cutting sand is blown by a mechanical blower through a nozzle, and the article is held in this stream until the sand has made the surface sufficiently rough. The articles may also be frosted by holding them in front of a frosting brush revolved rapidly in a polishing lathe. These brushes may be composed of little

branches of hard, fine wire, mounted by links on a wooden boss, or they may be composed of long tufts of the same wire rigidly fixed in a circular wooden box. If the latter are adopted, the frosting is done by holding the silver surface close to the tips of the revolving tufts in one hand, whilst the other hand holds a stick against the tips just above the silver, so as to lightly press them back and cause them to sharply strike the surface to be frosted. Experience is necessary to produce good frosting.

Hardening Silver Articles.—There is no method by which silver articles that have been softened by annealing may again be hardened without reducing them in thickness. The molecules of the metal, after stamping, drawing, rolling, spinning, or hammering, are, by the process of annealing, caused to flow or ease back into a mass of much less tension and, therefore, of hardness.

Marbleised Effect on Silver.—Such an effect on silver or silver-plated goods is produced in the following way: After removing the articles from the bath and washing and drying, they should be lightly gone over with a good-sized feather dipped in hydrosulphide of ammonia. When the dead surface of the silver has been sufficiently marbleised, wash in cold water only, and dry without using heat. Then lacquer with a transparent lacquer. Still more variegated effects can be had by using a 10 or 15 per cent. solution of caustic soda in warm water, to which is added as much pulverised sulphur as the solution will take up. Then proceed in the manner just mentioned.

Melting Silver in Open Fire.—Procure a small fireclay crucible in which to melt the silver. For a flux, use equal quantities of finely powdered charcoal and sal-ammoniac. Make up a large, bright coal fire in an open grate, and when the fire is quite clear break a hollow space in the centre. In this space place the crucible, and allow it to get red hot; then put in the silver, and draw some of the hot coals closely around and over it. Blow the fire with the bellows until the crucible gets white hot, when the silver will melt. Then add the flux to clear the surface from scum. Again make the crucible hot, and quickly pour the contents into an iron ingot mould previously made scalding hot. One or two ounces of silver may be melted at a time in this way. The flux may be stirred with a pointed rod of iron previously made red hot.

Oxidising Silver (*see* Oxidising).

Paper for Wrapping Silver.—This is prepared by soaking in a solution made as follows: 6 parts of caustic soda are dissolved in water until the hydrometer indicates 20° Baumé. To the solution add 4 parts of oxide of zinc, and boil until it is dissolved. Add sufficient water to bring the solution down to 10° Baumé. Paper or calico soaked in the solution and dried will effectually preserve the most highly polished silver articles from the tarnishing action of the sulphuretted hydrogen which is contained in such notable quantities in the atmosphere of large towns. Dry the paper in a place free from dust, as any gritty particles would scratch the silver.

Polishing Silver.—Silver cannot be polished by the application of a liquid. Pastes made of rouge and mercury are among the worst kinds of polishing materials that can be conceived. The apparent quick polish obtained by the use of these pastes is not a polish at all, but a thin film of mercury deposited on the metal by rubbing it with the paste. This film of mercury rapidly tarnishes on exposure to the air, and it also rots the metal by forming an amalgam with its surface. Pastes made with jeweller's finest rouge and oil are best for polishing silver, or the rouge can be used dry on a soft white rag. A mixture of finely divided chalk and best rouge can also be used, but both must be quite free from grit to avoid scratching the surface. Dealers in electro-plating requisites supply various excellent polishing compositions made up in the form of bars. These can be used by hand, or on swansdown mops revolved by machinery in a polishing lathe. Tarnish can be removed from silver by first heating and then swilling in a strong solution of potassium cyanide.

Polishing and Finishing Silver Fretwork Articles.—When finishing silver articles, if the fret cutting is done, take off the burr or

"fash" from the saw with a dead smooth file. Next rough polish by means of a buffing lathe, which consists of a central headstock with right- and left-hand mandrels, and fitted with fast and loose pulleys in the centre. The mandrels extend from 12 in. to 18 in., according to the nature of the work to be done, and each mandrel has a taper screw at the end on which to secure the polishing buffs. These may be of leather, linen, or a hard or soft brush, which again may be of bristle, soft brass, or even of hard steel as for scratch-brushing. The rough polishing is done with a circular buff, say 3 in. in diameter for small work. The leather, called "bull neck," is cut as round as possible, a small hole punched in the centre, and screwed on the taper screw of the mandrel, while the disc is turned up true with an old sharp knife, an upright piece of wood being used as a hand-rest. This is fed with prepared Trent sand and common oil, the article being held underneath the revolving buff and worked backwards and forwards till the scratches are removed. If the silver is very thin it is usually placed on a small flat piece of wood to prevent its being bent. At this stage the work is sent to be engraved or otherwise ornamented. The work should next be boiled in a strong solution of potash, 1 lb. of potash to 2 gal. of water, to remove grease and dirt. The leather buff and Trent sand is then put aside in a cloth to be used over and over again. A linen dolly about 6 in. in diameter is screwed on the mandrel nose, and rouge and water made into a thin paste is applied with the finger to the piece to be polished, which is then put in contact with the revolving dolly. This is repeated till a high condition of polish is attained. The final polish by power is arrived at with a lead lap fed with still finer rouge paste, and otherwise by "handing up." This consists in the work being polished by friction, using the ball of the thumb with fine rouge paste. Next the article is washed out in hot water, dried in hot boxwood sawdust, polished with a clean chamois leather and then carded. Another system is lightly to electro-plate the silver goods, and then hand-burnish the various parts in order to produce an effect of light and shade.

Stripping Silver from Plated Articles.—One method of removing silver from plated articles needs the use of a cold bath. The objects are hung in a large vessel filled with a mixture of 10 parts of sulphuric acid, 66° B., and 10 parts of nitric acid at 40° B. The length of the immersion depends on the thickness of the coat of silver to be dissolved. The liquid, when it does not contain water, dissolves the silver without sensibly corroding copper and its alloys; therefore, avoid introducing wet articles into it, and keep the liquid perfectly covered when not in use. The articles must be placed in the liquid so as not to touch each other, and in a vertical position, so that the silver salt will fall to the bottom. As the strength of the liquid diminishes, add nitric acid. This process is regular and certain, but slow, especially when much silver is to be removed. The second method needs a hot bath. Nearly fill an enamelled cast-iron pan with concentrated sulphuric acid, and heat to a temperature of from 300° F. to 400° F.; at the moment of using the bath, pinches of dry powdered saltpetre are thrown into it. Hold the articles with copper tongs in the liquid and the silver will rapidly dissolve without the copper or its alloy being corroded sensibly. If the process proceeds rather slowly, add saltpetre. All the silver has been dissolved when, after rinsing in water and dipping the articles into the cleaning acid, they do not present black or brown spots, but have the appearance of new metal. These two methods are not suitable for removing the silver from wrought and cast iron, zinc, or lead; in these cases it is preferable to employ an electrical method or a mechanical process. Old dissolving liquids become green after use; to recover the silver they are diluted with four or five times their volume of water, and then hydrochloric acid or common salt is added. The precipitation is complete when the settled liquor does not become turbid by a new addition of common salt or hydrochloric acid. The resulting chloride of silver is separated from the liquid either by decanting or by filtering, and is afterwards reduced to the metallic state by one of the usual methods.

Testing Silver.—Dissolve 1 oz. of bichromate of potash in 2 oz. of hot water, and add to this, when cold, 6 oz. of nitric acid. Keep in a glass-stoppered bottle. Make a deep scratch on an obscure part of the article to be tested, and on this scratch apply a single drop of the testing mixture with the tip of a glass rod. If a blood-red spot appears where the mixture was dropped, the article is of silver. To a practised eye the redness of this spot will indicate the quality of the silver, because pure silver nitrate combined with chromic acid forms a bright red silver chromate. Any alloy in the silver will diminish the brightness or intensity of the red in proportion to the quantity of alloy. The test gives a brown mark to German silver, a black mark to Britannia metal, but has no effect on platinum. Chromate of potash may be used instead of bichromate of potash; but this salt causes a purple stain to appear on silver if mixed with dilute sulphuric acid. The touchstone method as employed for gold (*see* Gold, Testing) can also be used. Silver keeps its greyish colour on the touchstone, whereas base metals will turn green. Impure silver may be partly dissolved in nitric acid, and the solution will have a blue tint if it contains copper.

Whitening or Blanching Silver.—The best way to restore the original lustrous whiteness of silver goods, lost or impaired by exposure to a sulphurous atmosphere or by having been often and perhaps carelessly cleaned, is first to anneal and then to pickle the silver, the latter portion of the process resembling the colouring of gold alloys. The annealing may be done in a charcoal fire or in the flame of a gas or oil blowpipe; the heat destroys all organic matter adhering to the surface of the article, at the same time oxidising on the surface the base metals with which the silver is alloyed. The annealing requires some care and attention, or else the workmanship of the piece will be lost. If the silver has been soft-soldered previously, it is unfit to be annealed, as the heat necessary for this would melt the solder. It is necessary to remove all stones, steel, or any material not silver or liable to be injured in the fire, and it is also advisable to remove pins, tongues, or other steel work from brooches, etc. Over- or under-heating must be prevented; in the former case, if the article is overheated, the silver is liable to melt; and if underheated, the adhering organic matter is not effectually destroyed, and the surface not sufficiently oxidised. In order to obtain the required degree of heat, and not to run a risk either of under- or over-heating, the article is held with a pair of pincers very close over the flame of the lamp so as to be covered with soot all over, and is then exposed to the blast of a flame, by means of a blowpipe, until the soot burns or disappears. When the article is cool, it is immersed in a boiling solution of from 1 part to 5 parts of sulphuric acid in about 20 parts of water; the quantity of the water depends upon the quality of the silver; the coarser this is, the stronger is the solution. The solution dissolves the extracted deposit of oxide and leaves a coating of fine silver on the surface. Good sterling silver will be whitened almost in an instant, common silver will take a minute or even longer; if the articles are left too long in the solution they turn an unsightly greyish colour, and the process has to be repeated. Common silver has to be treated repeatedly in this manner before the desired whiteness is obtained, and in some cases even will have to be silvered by the galvanic method. As soon as the article in the acid turns white it is transferred quickly to lukewarm water. The articles are then dried in sawdust, kept in an iron vessel near the stove or any warm place. Any places on the article desired to look bright are burnished with a steel burnisher. Silver which has become merely oxidised by exposure to the atmosphere, and not by repeated cleaning, is restored simply by brushing with a clean tooth-brush and a little carbonate of soda.

Silvering Glass

Recipes for silvering solutions are many in number. (1) A solution that is eminently suitable for an inexperienced operator, and one that can be used on glass with painted lettering or ornament, is given below:—In 1 oz. of distilled water dis-

solve 48 grains of nitrate of silver, then add, drop by drop, strong ammonia until the precipitate that first forms is nearly all dissolved. Filter through asbestos or glass wool in a glass funnel, and make the mixture up to $1\frac{1}{2}$ oz. Then dissolve 12 grains of Rochelle salt in 1 oz. of distilled water; heat to boiling; add 2 grains of silver nitrate dissolved in 1 dram of water; cool, filter, and make up to $1\frac{1}{2}$ oz. Mix the two solutions and pour on the glass. (These quantities may be increased or diminished according to the size of the glass.) Previous to doing this, however, the glass must be made scrupulously clean by rinsing with nitric acid and then washing with distilled water; stand the glass on its edge to drain, but do not leave long enough to dry. If the water runs away from any portion of the surface or forms into rings, the glass is greasy and should be washed (exercising great care if there is painted work upon it) with soda and water. Before pouring on the silvering solution, the glass should be carefully levelled on a table, and after the silver is thrown down, the solution should be poured off and a fresh lot poured on in order to thicken the deposit. Finally apply a covering of shellac, and on this, when dry, a coat of red-lead paint. (2) Clean the glass that is to be silvered, first with whiting and water, and rinse well with distilled water; wash over with nitric acid, and then again with distilled water, and stand the glass in a rack to drain. Dissolve 100 grains of silver nitrate in $2\frac{1}{2}$ oz. of distilled water, add 62 grains of strong ammonia (sp. gr. ·880), and then make the solution up to 19 oz. with distilled water; next mix with the solution $7\frac{1}{2}$ grains of tartaric acid dissolved in 30 grains of water. Place the glass on a levelling table kept at a temperature of 40° C., and pour on the mixture in sufficient quantity to cover the plate. In about half an hour a perfect coating of silver will be obtained. The surplus solution is now poured off, and a second solution containing twice the quantity of tartaric acid is poured on in order to thicken the deposit. Wash the glass with distilled water; allow to drain until quite dry, and finally coat with red oxide paint.

Removing Silvering from Glass.—The easiest way to remove the silvering from glass is by means of a wide sharp chisel, the edge of which must be free from notches, or it will damage the polish of the glass. The flat side of the chisel is used next the glass, pressed firmly, and moved in a straight line. Keep the glass flooded with water. Strong potash laid on with a brush, and allowed to remain for a time, will soften the painted backing so that the silvering may be stripped off. Careful cleaning will be necessary after strong potash has been employed.

Re-silvering Glass.—It is worth while trying to re-silver the scratched portion of a mirror before having the glass entirely re-silvered; it might be successful or it might not. Anyhow, no harm will be done. The recipe in which Rochelle salt is employed (*see* the first recipe given under the heading "Silvering Glass") gives the best results, and is most likely to succeed. Any recipe containing caustic soda is not advised, as this would probably remove the paint from the backing and thus spoil the mirror still further. The silvering solution could be poured over the scratched portion, the plate being placed on a levelling table and slightly warmed to cause the deposition of the silver.

Silvering Metals

Distinguishing Quality of Silver-plated Goods.—The quality of electro-plate is often distinguished by the following marks:—AA, A, B, C, D. These letters denote the amount of silver deposited on the metal. Thus, articles marked AA have the thickest coating of silver on them; this is the extra best quality manufactured. For ordinary use A is considered best quality, and the letters B, C, and D denote lower qualities, having less silver deposited on them.

Silver-plating without Battery.—As silver-plating without a battery is done by the chemical substitution of silver for metal dissolved from the articles being plated, it is clear that such a thick and firm coat of silver cannot be put on by this method of plating as by the electro-plating process. One of the best processes for silver-plating without a battery is that invented by M. Roseleur.

The solution is formed as follows :—Dissolve 4 lb. of washing soda in 5 pt. of distilled water and place in a vessel furnished with a bent glass tube connected by a rubber pipe to another vessel constructed to generate sulphurous anhydride gas. Pass this gas through the soda solution until the crystals first formed are all dissolved and the liquid slightly reddens litmus paper; then set aside for twenty-four hours. Next stir well, and test for acidity. The liquid should slightly redden blue litmus paper. Pass more gas if too alkaline, or add more soda if too acid. Then stir in enough silver nitrate to take up nearly all the solvent, ceasing to stir in the silver when it dissolves slowly. This will deposit thick coats of pure silver on well-cleaned copper, brass, and bronze articles; but it also deposits its silver on the sides of the vessel in which it is contained. Its metal is renewed by occasionally adding some nitrate of silver solution and some bisulphite of soda. This solution is used cold. Another solution, to be used boiling hot, is made as follows :—Dissolve 10 oz. of silver nitrate in 5 pt. of distilled water, then add 60 oz. of potassium cyanide dissolved in hot distilled water. These solutions will only silver copper and its alloys, and but thin films of silver can be deposited from them, because deposition ceases when the articles are coated with silver and thus protected from the chemical action of the solvent contained in the liquid.

Silver-plating Paste.—Cheap silver-plating pastes and powders are not only useless, but are really harmful; they are generally made from mercury compounds, and the mercury amalgamates with the metal on which the paste is spread; then in a few days the bright surface becomes tarnished and the metal becomes honeycombed and dull. The best material to use is a silver compound. A silver-plating powder may be made by mixing together with a little water 1 oz. of chloride of silver, 3 oz. of common salt, and 2 oz. of cream of tartar; this should be rubbed on the articles to be plated. If this preparation is too expensive, a silver bronze paint could be used; this could be made by rubbing up aluminium powder with sufficient pale copal varnish to form a stiff paste and thinning out with turpentine.

Silvering Squares.—Dissolve $\frac{1}{4}$ oz. of silver nitrate in a pint of rainwater or in distilled water, and add table salt until it ceases to throw down white curds; then drain off all the water, warm the white curds a little, and drain them nearly dry. Now add an equal bulk of cream of tartar, and stir all together until well mixed. Then add enough whiting to make a stiff dough, and press this into moulds of the required shape. Or make into a cake and cut it up in squares. These must then be dried at a gentle heat in a dark place. When moistened with water and rubbed on clean copper, bronze, or brass surfaces, these squares will coat them with silver.

Silver-point Drawing

The paper for silver-point drawing is made from drawing paper by applying an even coating of Chinese white (zinc oxide) in the form of a moist water-colour. The most suitable metals are pure silver (not the alloy with copper, as used for coinage), an alloy of silver with 2 or 3 per cent. of lead, an alloy of 2 parts of lead and 1 part of tin (solder), and an alloy of 3 parts of lead and 1 part of antimony (type metal). The reason why the metal leaves a mark is that the pigment has a rough surface or "tooth," and abrades the metal.

Size

Size is really gelatine or glue dissolved in water, and it is made from various materials. Parchment size is made from waste cuttings of parchment and cuttings from calf and goat skins. Glue size is made from cuttings of hides, hoofs, etc. Pith size is prepared from horn piths; bone size from bones. Size is used by painters and whitewashers, woodworkers, papermakers, paperstainers, wallpaper manufacturers, carpet manufacturers, etc. To make size, place the material in a boiler with water, and heat it by steam under pressure or by open fires until the tissues are softened and the gelatine has dissolved; the liquid is then strained through sacking or filtered in a filter press and run into barrels to cool. If properly made, the size will set to a

stiff jelly when cold. It is usual to add a small quantity of a preservative such as carbolic acid, to prevent the size liquefying and becoming putrid. Glue is made from size by pouring it into wooden moulds. When set, the blocks are turned out of the moulds on to a slab, and cut into cakes by means of wires strung on a wooden frame. The glue cakes are placed on wire netting and dried slowly in a current of air, the frames being moved to a warmer room when the glue is partly dried. After the glue cakes are dried, they are washed on the surface with a little water and a brush to remove dust and stains, and then thoroughly dried again.

Gilder's Size.—A size suitable for use in gilding glass, wood, china, metal, etc., is made as follows :—Put 1 lb. of good drying oil in a metal pot over a slow fire and bring to the boil; then gradually add 4 oz. of finely powdered gum anime, and continue the boiling until a thick consistency is obtained. Strain the size through silk, and keep it in a closely-stoppered bottle. It is claimed to keep tacky longer, and to give more lustre than any other size.

Glue Size.—For this, put about 4 oz. of best white glue into a tin vessel and just cover with cold water, and allow to soak until it is so soft that the finger can be pressed through it; this will be in from three to four hours. Place the vessel in hot water, and, when the glue has quite dissolved, put a thumb and first finger into it, when it will be found that they cannot touch each other through the glue. Now slowly pour in warm water, stirring until one finger can be felt to resist the other, this being an indication that the size is of the right consistency.

Parchment Size.—Parchment size is made by placing parchment cuttings in a pan, covering with water, and allowing to simmer over a very slow fire till the liquid becomes thick; the size is then strained through a sieve. Great care must be taken that the size does not burn on the bottom of the pan; it would be best to employ a steam-jacketed pan with a lid, so that the cuttings could be heated with the water under pressure, and hence at a higher temperature than that of boiling water.

Refining Size.—Size may be refined either by allowing it to settle in a warm place and pouring off, or cutting off, the clear portion, or by filtration through layers of flannel placed upon the perforated bottom of a barrel or tank.

Sizing Walls.—Sizing a whitewashed wall before papering, so as to bind the whitewash and to prevent it flaking off, is done with an oil size composed of 1 part (by measure) of oil, 1 part of japan gold size, and 2 parts of turpentine. This should dry quite hard before the paper is pasted on. If it is not convenient to apply the oil size, well wet the wall with water, scrape off the whitewash, and, when dry, it will be ready for papering.

Starch Size.—This should be a smooth mass of uniform consistency, odourless, not injurious to any textile material or liable to alter the colours of dyed or printed fabrics, and freed from lumps of any kind and from all sediment, says the "Journal of Decorative Art." The starch requires careful treatment. Mix it with cold water to a smooth cream and pour this slowly into a sufficient quantity of actually boiling water, continuing the boiling until a clear, uniform paste is formed. If, instead, the boiling water is poured into the starch cream, the resultant paste will contain masses of undissolved starch and will be quite useless. The body of the size is made up then with dextrin or gum, and softeners, such as soap or soluble oil, are added, following with fat, or animal or vegetable waxes, and then with gelatine or glue if these are necessary. Finally, antiseptics or preservatives, such as chloride of zinc, salicylic acid, etc., are added. All the additions take place under continuous stirring, which is best performed in tilting jacketed kettles having mechanical stirrers; hand-stirring does not produce a uniform mixture, nor does it break up all the little lumps. The size should not require straining, but should be ready for immediate application, either hot or cold. If the size is kept for some time before being used, thoroughly stir before applying.

Stiffening Size.—Size can only be stiffened by boiling until a drop cooled on a glass plate sets sufficiently firm.

Whitewashers' Size.—The jelly size used by whitewashers is made by soaking glue in cold water overnight, and then melting down by a gentle heat. If a large quantity is to be made up at a time, take 1 part of glue to 4 parts of water, and add 1 part of carbolic acid to every 100 parts of size, otherwise it will not keep.

Skins (*see also* Taxidermy)

Cleaning Skin Rugs.—If the rugs are very dirty, they should first be washed in hot water in which some soda has been placed, the hair being well rubbed with soap. The rugs should then be well rinsed in cold water, and hung in the air until dry. The hair or fur will now be matted and the skin itself stiff, but a vigorous beating with a stick will cause both hair and skin to resume their former condition. The hair should next be combed and well brushed. For small skins the following method is preferable. Rub the hair down with a cotton-wool pad saturated with benzoline; if the skins are extremely dirty, use turpentine first, and then benzoline. Having soaked the skins in the liquid, rub the hair up and down until quite dry with a plentiful supply of fine sawdust. The dust can now be removed by vigorous beating, shaking, and blowing with a pair of bellows.

Cleaning Skins by "Dry" Process.—The skins may be soaked in petroleum ether in a closed tank or pan for two or three days, removed, wrung out, dried, brushed, and combed; or they may be well brushed all over with a mixture of bran and benzoline, and, after drying, brushed and combed. Another method is to brush the skins with a solution of olive-oil soap in methylated spirit, followed by sponging with clean methylated spirit.

Dogskin Rug.—A dressed dogskin will not dry in wet weather if alum and saltpetre were used in the curing, these substances being extremely sensitive to moisture. Lay the skin, hair downwards, on a table, and rub on bran until the exudation is taken up; then dry off the skin slowly, a safe distance from the fire. Should the coat be at all greasy, rub it down with benzoline, and hang it in the open air until the spirit has evaporated. Then comb out the hair in sections with a strong steel comb, holding the roots firmly, and using no unnecessary force. The backing should be of fine canvas; the margin of red or blue baize, either crimped or scalloped.

Dressing Skins for Rugs.—The best method of dressing lamb and calf skins when freshly taken from the animals, for rugs, etc., is the ordinary tawing process. First place the hides for three days in the following solution: ½ lb. of alum (potash) and 1½ lb. of common salt to 1 gal. of water. On removal, pare down each skin evenly all over with a sharp knife, finally finishing with a fragment of glass or a piece of pumice-stone. The hair can then be cleaned by washing well in a warm bath with plenty of soft soap and soda, and finally rinsing in clean water. The skin on drying will become hard, but can be rendered supple by beating it well with a stick, rubbing between the hands, and further scraping with pumice. The hair, having been well rubbed down with common benzoline, should be well brushed and combed.

Hair Falling Out of Skins.—The hair often falls out of the dressed skins of wild sheep, goats, and deer, this being not necessarily caused by improper curing in the first place, or by the ravages of moths or other insects, but by the natural brittleness of the hair at its base. In many cases this natural defect in the hair cannot be remedied; but various methods of treatment have been recommended, and the most successful of the recipes are given below: (*a*) Rub a fair quantity of lard oil into the back of the skin, and afterwards remove superfluous grease with bran or sawdust; (*b*) dress the hair itself with turpentine; or (*c*) saturate the back of the skin with a 20 per cent. aqueous solution of formaldehyde, and allow to dry. But after the adoption of any method, the hair that is already loose should be removed by brushing.

Moleskins, Cutting and Joining.—When cutting mole or any other kind of fur, do not use scissors; lay the skins with the fur underneath, and with a sharp knife cut to shape on the skin, or flesh side. First pare away the irregular edges of fur, so that the skins may lie edge to edge without either overlapping or revealing

vacant spaces. Assuming, for instance, that a waistcoat is to be made, having arranged the skins so that the fur runs the same way, secure the approximate size of the vest, before sewing the pieces together, by laying down the paper pattern and marking about half an inch beyond its edges. Permanently join the skins together by "stoating." As working button-holes through a fur forepart is impracticable, the fronts are invariably furnished with a "fly," in which the buttons remain concealed during wear.

Moleskins, Dressing.—(1) A quick and most effective method of dressing mole and other small skins to render them soft and supple is to steep them, freshly stripped from the trunk, in a strong solution of American potash in water, until the upper skin is removed, care being taken not to leave them too long in the liquid. Then dry them in sawdust, which will absorb the moisture. Next, neat's-foot oil, with a small addition of camphor or oil of birch, which imparts a pleasant smell, is applied sparingly to effect entire softening. A final application of benzoline and a brisk brushing will remove the surplus oil, and bring out the natural gloss of the fur. (2) Skins which have been cured with saltpetre and alum may be rendered pliable by first soaking them until quite soft in a solution of white leather dressing, namely, 1 qt. of water, ¼ lb. of alum, 1 oz. of common salt, and about four handsful of bran or oatmeal. Then, on removal from the bath, the skin side should be well curried with pumice-stone or the edge of a blunt knife and well worked between the hands. The fur can be cleaned and dried by dressing it well down with benzoline, and passing the skin through fine sawdust until the moisture has been absorbed, when the dust can be beaten, shaken, and blown out with a bellows. This system of curing can be employed with advantage on fresh skins, the skins being allowed to soak for three or four days. The quickest and simplest method, however, of preserving and rendering soft the skins of small animals, when freshly removed from the body, is described at the beginning of this paragraph.

Otter Skins, Dressing.—When received at the fur-dresser's, otter skins are almost invariably cased, and are first cut open longitudinally down the chest and abdomen. The pelt is soaked in salt water overnight, for the purpose of softening it and preparing it for "breaking." The following morning each skin is placed on a beam, and a workman proceeds to break up the grain of the membrane. The pelt is now washed in warm soap water and the water removed, as in the case of beaver skins. If the overhairs are to be plucked, that is done next. The choicest skins are left in "the hair," the number amounting to about a third of the total quantity dressed. The pelt, which has become less bulky and quite soft from frequent handling, is now placed on a beam and skived. It is next dampened with cold salt water and allowed to remain thus over-night. The next morning it is stretched lengthwise and crosswise and partly dried, when it is ready for the leathering process. It is well rubbed with butter, or some other animal grease, and placed with others in a tramping machine, where it is worked for hours. On removal the skins are revolved for three or four hours with a quantity of hardwood sawdust in a cleaning drum, under which there is steam heat or a charcoal fire. Next they are placed in tubs with a quantity of sawdust, where they are tramped for about three hours by barefooted workmen, and on removal are thoroughly stretched. The leather side of the pelt is dampened overnight, and then shaved down to a uniform thickness, as in the case of beaver skins. A skilful workman can shave thirty or forty otter pelts a day. The skins are next stretched, dried, and placed for a second time in tubs with hardwood sawdust, and tramped for two or three hours, then removed, stretched again, and returned for two or three hours' further tramping, after which the fur is straightened out with a fine steel comb. The skins now receive a thorough beating with rattans to remove every vestige of sawdust and to lighten up the fur. If they have been unhaired, they go to the workman, who removes all scattering hairs by means of a broad-bladed knife. Otter skins having coarse

overhairs are greatly improved in appearance by plucking, as the fur is extremely soft and dense. When plucked, the fur is used either natural or dyed various shades of brown. A few skins are clipped. This fur is very durable, the leather being strong and fine-grained.

Preparing Skins of Small Fur-bearing Animals.—Pelts that are to be placed at once on the market should be sold all ready for making up; that is, the pelts should be finished with a white leather or soft dressing. The skin should be removed from the body by the cross rump incision; make the first cut from flank to flank in a semicircle under the tail, then draw down the flap covering the stomach, pull out the tail and legs from the skin, and sever the joints of the legs at the toes. Turn the skin inside out, and strip it down to the fore limbs, which should be severed like the hind legs; then, passing on to the head, skin down to the tip of the nose, and remove the skull, body, and limbs. The pelts should now be placed hair inwards on suitable lengths of circular wood (a broom handle will hold half a dozen or more skins of mink and ermine), all flesh and fat carefully pared away, and the tails split. Put the skins in a cool place, and keep them constantly damped with either of the preparations that are here given: (1) Flour 6½ oz., alum 3¼ oz., salt 1½ oz., olive oil 1⅓ dr., and two or three eggs, adding sufficient warm water to form a paste; or (2) rock salt 2 lb., alum 1 lb., sal-ammoniac 1 oz., warm water 2 gal. The dressing should be applied for from three days to a week, according to size. When the skins are dry, rub them down with coarse glass-paper until an even thickness is obtained, then withdraw the poles and rub the skins well with bran, in order to remove the salt. A final rubbing between the hands and beating with a stick will render the pelts supple and ready for packing. Exceptionally fine specimens of such animals as the fisher marten, long-tailed and common skunk, mink, sable, and sea otter, command good prices when prepared as natural history specimens and sold to museums, etc. Raised heads of animals are often in demand for necklets, etc., so that the skull should be preserved with a small percentage of the pelts.

Rabbit Skins, Dressing.—The following is a reliable method of dressing rabbit skins. On removal from the trunk, entirely strip the skin of any adhering particles of flesh, fat, and superfluous tissue by means of a blunt knife, being careful to avoid making any gashes in the skin. Immerse it then for about twenty-four hours in a solution composed of 1 lb. of alum and ¼ lb. of common salt in 1 gal. of tepid water. On removal, make a warm solution, to the consistency of cream, of flour and water, and, having immersed the skin therein for a few minutes, rinse it out. After drying, rub the flesh side down with pumice-stone and glasspaper until it becomes perfectly supple. The fur should then be dressed down with pads of cotton-wool saturated with benzoline, which can be dried off by applying fine dry sawdust. This is finally removed by vigorous beating with a light stick and the use of bellows.

Sealskin, Dressing.—The following method of preparing sealskins for use will be found quite satisfactory. Having removed the skin from the carcase, roughly trim off as much fatty matter and tissue as possible; then place the entire hide in a solution composed of 1 lb. of alum and ¼ lb. of common salt to each gallon of warm water, and leave it there for about two days. When removed from the solution, lay the skin hair downwards on a table, and by working it gradually over the edge of the table, pare down the whole hide evenly with a sharp knife, or with one of the tools specially made for the purpose. The fat should next be removed by washing the hide, until it saponifies, with a strong caustic potash or pearlash lye, rinsing it well afterwards in cold water. With sufficient after-working or currying, the skin will become quite supple. When a white leather dressing is required, the skin must be treated as follows: If on removal the skin is quite fresh, the fat should be drawn out at once as directed; but if there is any sign of "slipping" of the hair, the skin should be placed for about a day in the curing solution. When taken out, the skin is stretched hair downwards on a table by means of a few

tacks at the edges. The following solution must then be applied to it three or four times daily for a week or ten days: Rock salt 2 lb., alum 1 lb., sal-ammoniac 1 oz., warm water (to dissolve the ingredients) 2 gal. When, on pressure from the finger, the skin appears quite white, it may be dried off. A final rubbing between the hands, beating with a stick, etc., will complete the operation. A vigorous brushing will remove the long hairs which may have been severed at the roots in the paring down. A final application of benzoline will, on drying, restore the natural gloss to the fur.

Sealskin Garment, Renovating.—Lay the skin on a flat surface, and brush it briskly. Warm some new bran in a pan, stirring it to prevent burning; rub it through the fur with the hand, then give the skin another sharp brushing. Parts that are moth-eaten or much worn should be carefully cut out with a knife from the wrong side and fresh pieces sewn in.

Sealskin, Sewing.—Sealskin may be sewn so that the join is invisible. The sewing is done from the wrong side, and the two edges are drawn together carefully till they meet and form a slight ridge. Splitting the skin, as is done with cloth, is not necessary, because the small stitches which are caught through are completely hidden by the fur. Very fine silk or soft cotton must be used, and each stitch should be pulled gently to avoid tearing the skin. None of the fur should be taken in with the sewing, and the two edges must not be allowed to overlap. A No. 8 size needle, of the kind known as egg-eyed betweens, procurable at a draper's shop, may be used.

Sheepskin, Dyeing.—To dye a sheepskin an orange colour, thoroughly wash the skin in warm soap and water to remove any grease or dirt, then rinse in clean warm water. The skin should next be placed in a dye bath made by dissolving 1½ oz. to 3 oz. of any aniline orange in 1 gal. of warm water, and adding a few drops of dilute sulphuric acid. After remaining in the bath, which is kept at a temperature of about 170° F., for half an hour, the skin is removed, dipped into cold water, wrung out, and dried. The dye may be bought in packets from a chemist. It will be advisable to first try the dye on a little white wool to see if the tint is suitable.

Sheepskin Rugs.—Sheepskin mats or rugs that are hard and crackle when walked over can be softened first by reducing their thickness and then by applying grease. The skin, if very thick, should be reduced by scraping with a rounded rasp or curry-comb whilst nailed out flat on a firm, hard table. When all inequalities have been levelled, rub with considerable force a little fresh lard or vaseline over every part till the skin has become soft and pliant. The process may be resumed time after time for several days. When thoroughly soft, the skin should be well rubbed for several days with sawdust that does not contain resin, or with bran, to get off all the greasiness that rises to the surface. Next some pipeclay should be rubbed vigorously into the re-stretched skin, and left to see whether it discolours the grease. Beat and scrape off any discoloured pipeclay, and put a new lot on till it remains for twenty-four hours without exhibiting signs of greasiness. Then brush and clean the hair side, using a large clean cotton cloth dipped in paraffin and wrung out dry. Rub the hair hard; then rinse the dirt out in the paraffin, and repeat the process till all dirt is removed. The sheepskin can be cleaned with soap and water as follows: -Dissolve 1 lb. of soap in 2 qt. of boiling water--rain-water if possible. Put half of this in a tub with 4 qt. of cold rain-water, and rub the sheepskin with the suds till they have extracted as much dirt as possible. Then use the other quart, diluted as before, to get the rest of the dirt out. Passing the sheepskin through a roller wringer will help matters considerably. Rinse very thoroughly in warmed rain-water, and pass between the rollers. Dry in the sun, the flesh side being exposed. Shake and alter the position of hanging frequently as the drying proceeds. A little washing blue added to the last rinsing water will make the wool whiter.

Skull, Bleaching

The oil must first be removed from the skull. This can be done either by soaking

the skull in petroleum spirit, or by boiling in a solution of caustic soda, 1 part in 10 parts of water. If the soda solution is used, wash well in clean water subsequently. To bleach the skull, take 1 part of chloride of lime, make into a paste with a little water, then add more water to 10 parts, also a few drops of hydrochloric acid, and allow the skull to remain in this till perfectly white; remove, wash well, and dry slowly in a warm place free from dust. (*See also* Bone, Bleaching.)

Fig. 538.

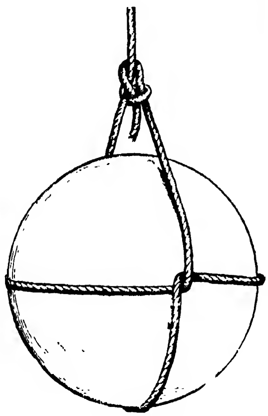


Fig. 539.

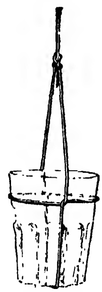


Fig. 540.

Fig. 538.—Loose Overhand Knot
Fig. 539.—Ball Slung on Line.
Fig. 540.—Tumbler Slung on Line.

Slinging Tumblers, Balls, etc.

To sling a ball on the end of a line, take the end of the line, and tie a loose overhand knot, which is simply one-half of a common reef knot *a* (Fig. 538). Next form a bowline *b* (Fig. 538). Now open out the overhand knot a little, and place the ball between the parts as shown by the arrow. See that the lower "bite" is in the centre and the others at right angles to it, and also that the hitches come exactly opposite each other. A glass ball or billiard ball, no matter how highly polished, will be firmly held, as shown in Fig. 539, as long as the weight of the ball remains on the line. This method of slinging is invaluable for open vessels containing liquids which require to be slung on end, such as tubs, open casks, paint and oil drums, etc. It is sometimes necessary, in case of accident, to lower a tumbler down a well or pit. Fig. 540 shows the same "bend" thus in use. The bowline is not tied close to the ball, but 4 in. or 5 in. above it (*see* Fig. 540; the line is shortened in Fig. 539 to save space).

Smoke-producing Mixture

The following is a recipe for a mixture that will produce a dense smoke when ignited. Mix together 7 parts of chlorate of potash, 1 part of charcoal, and 2 parts of ammonium chloride, all in powder. Handle the chlorate cautiously.

Snake Skin (*see* Taxidermy)

Snow Tree

A snow tree in a bottle of water may be made in the following way. First cut off the bottom of the bottle. Then apply two or three coats of varnish to a small branch of a tree having a number of short twigs, the whole of which will go into the bottle. Apply varnish also to the cut end to prevent water entering. When the last coat of varnish is partly dried and tacky, "frosting" (fine flake glass) may be dusted all over it; this will produce the appearance of hoar frost. The tree may then be placed in the bottle, and the bottom cemented in place by Canada balsam.

Soapstone (*see* Talc)

Soda

Carbonate of soda mentioned in recipes and formulæ is pure dry carbonate of soda (Na_2CO_3), unless otherwise stated. Washing soda is also carbonate of soda, but it contains in addition much water of crystallisation, its formula being $Na_2CO_3 10H_2O$. One hundred parts of washing soda contain 37 parts of carbonate of soda and 63 parts of water; 37 parts of dry carbonate of soda are therefore equal in their effect to 100 parts of washing soda. If this fact be borne in mind, then either dry carbonate of soda or washing soda may be used in any preparation, provided the proper proportions are worked out. In the manufacture of washing soda, sulphate of soda,

prepared as described in a paragraph below, is mixed with coal slack and limestone and fed into a reverberatory furnace with a revolving bed. The mass fuses, and the principal products are carbonate of soda, sulphide of lime, and carbonic oxide. The fused mass is run into iron waggons, and, after cooling, the blocks are broken up and treated with water in large tanks, which are run in series, the water passing from one to the other, so that the more concentrated liquor passes over new material. The concentrated solution of carbonate of soda is run into a pan placed over a reverberatory furnace, the heat from which serves further to concentrate the solution; from this tank it is gradually run on to the hearth of the furnace, where it forms a pool bounded by solid material. The flame of the furnace passes directly over the surface of the liquid and, as evaporation proceeds, the carbonate of soda separates in the solid form; it is raked out towards the fire, becoming hotter and hotter until finally it is drawn out at the furnace door, thoroughly calcined. This is soda ash, which is dissolved in a very small quantity of water, the clear liquid being run into large hemispherical iron pans, where it crystallises in a solid mass like ice; this is washing soda. As will be seen, a large and expensive plant is required.

Bisulphite of Soda (*see* Preservative Powder).

Caustic Soda.—This, chemically, is sodium hydrate (NaOH), which is a white and brittle solid, extensively used in the arts.

Cleaning Dirty Washing Soda.—The proper way to treat dirty soda is to calcine it in a furnace, dissolve in water, filter, and evaporate until the material crystallises from the solution. But a simpler method is to wash the soda with a very little water, drain off the dirty liquid, and dry the soda in a warm oven.

Soda Water Cylinders, Charging.—In charging cylinders with soda water, they are mounted in a frame, preferably on trunnions, so that they can be gently rocked while the carbonic acid is passing in. The air space occupies about one-eighth of the capacity of the vessels. The water is pure, and 5 gr. to 15 gr. of carbonate of soda are added for each pint. The connection to the carbonic acid cylinder is made with a copper pipe of small bore fitted at both ends with flanges and loose screw plugs. The pressure gauge is the usual form with a dial, and is attached by a T-piece to the plug on the carbonic acid cylinder. The best position in which to place the cylinders while charging with the gas is a slanting one. There is no advantage in having too great a pressure, as it is more difficult subsequently to fill the water into bottles if it is very highly charged with the gas.

Sulphate of Soda or Glauber's Salt.—The Leblanc method of making this substance is as follows:—Common salt in fine crystals is fed into a large iron still connected with several tall towers made from drain pipes, down the interior of which water is allowed to run from a tank. A quantity of oil of vitriol is then run into the pan and, after the first reaction has

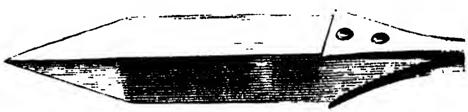


Fig. 541.—Soldering Bit.

ceased, heat is applied until all the hydrochloric acid has been evolved and the residue is a neutral sulphate of soda. The hydrochloric acid is condensed by the water in the pipes and recovered. The sulphate of soda is dug out of the pan. When this is dissolved in water and crystallised out, it is known as Glauber's salt.

Soldering

To solder is to unite two metals by means of an alloy, which must necessarily melt at a lower temperature than the metals to be joined. Soldering may be divided into two distinct kinds: hard-soldering or brazing, in which the heat of a blowpipe or brazing hearth is necessary to fuse the solder (this is described under the heading, "Brazing"); and soft-soldering, in which the solder may be applied readily at the ordinary heat of a tinman's soldering bit. The process of soft-soldering will here be considered. Soft solders melt at a relatively low heat. As a

rule, they are used for making joints in tinplate, lead, zinc, and some classes of brass. Plumber's solder consists of tin 1 part and lead 1 part. A solder consisting of tin 2 parts and lead 1 part melts at a heat of 338° F., though tin melts at 440° F. and lead at 620° F. Before any soldering can be done the copper bit (Fig. 541) must be tinned. Heat it in a fire or stove to blood-red, grip it in a vice, and quickly file the four faces quite bright; dip the end of the bit in killed spirit (made as described below), rub it on a piece of sal-ammoniac, hold a stick of solder to the point of the bit, and melt a little on the lump of sal-ammoniac, rubbing and turning the bit at the same time. If it is hot enough the solder will flow and coat the face of the copper. Dip it again in the spirits, and the operation is complete. Another method of tinning a bit is with a piece of clean tinplate, about 4 in. square, nailed to a piece of wood. Heat and file the bit as before, dip the end in killed spirit, and then put a pinch of resin on the tinplate, melt a little solder on it, and rub the bit briskly on the latter. The solder will quickly flow on the clean part of the soldering bit. Do not make the copper bit red-hot after tinning, or the whole process of filing and tinning will have to be repeated. The workman should aim so to use the bit that it remains tinned, because re-tinning involves loss of time and the filing quickly wears away the copper. Excessive heating is the cause of bits being spoilt.

Aluminium, Soldering (*see* Aluminium).

Fluxes for Soldering.—A flux is necessary to remove all impurities from the surfaces so that the solder may make perfect contact with them. The flux in use for soldering nearly all kinds of sheet metals is killed spirit, more properly zinc chloride. To prepare it, take a large earthenware pan and place a quantity of clean scrap zinc on the bottom. Half fill the pan with muriatic acid; a dense and irritating vapour will rise, and will continue to do so until bubbling ceases. When the zinc and chlorine are united, the acid is said to be "killed." Put a slate over the pan and leave it for, say, twelve hours; then pour off the clear liquor and bottle for use. Killed spirit may be made on a small scale with a pennyworth of muriatic acid and a few zinc slating nails or a piece of sheet zinc. If the acid is not entirely killed by using an excess of zinc, the free acid present may cause a black stain to show on the work when soldering. To prevent this, some add a piece of washing soda or sal-ammoniac to neutralise the free acid. It is always best, after using strong spirit, to wipe with a wet rag, and to clean off afterwards. To solder brass, copper, or bright iron, or to tin metals before soldering them, use the killed spirit neat; but where there is but little oxide to overcome, as in tinware, use half water and half spirit; a pointed stick of wood or a small brush will hold enough flux for self-soldering jobs. Sal-ammoniac, being the chloride of ammonia, forms a useful flux for tinning copper goods. Other fluxes—not of an acid nature—such as resin, Gallipoli oil, Venice turpentine, Russian tallow, palm-oil candle, etc., act by flowing over the surfaces and preventing oxidation. Powdered resin is the chief flux of this kind and is particularly useful for soldering tinware. Acid fluxes cause subsequent corrosion, but resin and the fatty fluxes are free from this action.

Simple Soldering Jobs.—An often-occurring soldering job is the mending of a pinhole in the bottom of a tin-plate teapot or kettle. First scrape a clean patch round the hole. Heat the bit—do not burn it—in a fire or gas-stove. Apply a little killed spirit to the cleaned surface by means of a brush dipped in the spirit and then pressed almost dry. Clean the hot bit by dipping just its tip into the spirit, and then, holding it nearly horizontal, apply it to the solder and try to pick up a drop of it. This may require some practice. When successful, transfer the drop of solder to the cleaned patch, raise the handle of the bit, and the drop will flow off at the point. Move the bit round the hole and the solder will cover the place. Allow to cool, and then test with water. When a hole has to be patched, cut a piece of tin-plate to cover it, allowing a good margin. Trim off the corners, bend the patch to fit the body, place it in position, and scratch a line round it on the article. Then clean the place and for ¼ in. beyond the mark. Brush killed spirit on the underside and edges of the patch, hold firmly in position, and solder. The molten solder

will run in between the patch and the body of the article.

Soundproofing Floor (*see* Floor)

Speaking Tubes

Speaking tubes are usually run in zinc from ⅝ in. to 1¼ in. in diameter, according to requirements. The tube should be run in as straight a line as possible, and the fewer bends and angles the better. Where it is necessary to use a bend, it should be of the same material as the tube; they are made in cast zinc in each size. The mouthpiece ends are fitted with brass elbows, tinned for connecting to the zinc tube, and screwed to receive the mouthpiece. Sometimes the speaking tube is run in lead pipe and gas barrel; but these materials are not so efficient in working, especially the latter, owing to the inner lining corroding, and blocking the passage. The longest distance through which the sound can be heard is about 400 yds. Another material often used is papier-mâché thoroughly treated with bitumen. This has the advantage of being very light. Vulcanised indiarubber, braided with mohair, is often used. Gutta-percha is said to have the best carrying properties. Nearly all the faults that are met with in speaking tubes can be traced to an excess of bends or to rough tubing. When there are many bends use large tubing.

Finding Leak in Speaking Tube.—The smoke method may be employed for finding a leak in a speaking tube. The best method of generating a large quantity of smoke is by bringing together the vapours of hydrochloric acid and ammonia. The apparatus shown in Fig. 542 will serve for the purpose. It consists of two bottles with sound corks, in each of which two holes are made with cork borers. Into one of the holes is fitted a bent glass tube A reaching to the bottom of the bottle; into the other hole a short bent glass tube B is fitted. The two longer tubes are connected by means of a rubber tube to a Y-shaped tube C, and to this is attached a third piece of rubber tube and a jet to blow through. The two shorter glass tubes are also connected to a Y-shaped tube D, and similarly a rubber tube and short glass tube are attached to the third limb. The short glass tube is passed through a hole in a cork which will fit the mouth of the speaking tube tightly. The farther end of the speaking tube is closed with a cork, a little strong hydrochloric acid is placed in one bottle and strong ammonia in the other; on blowing through the tube a fume of ammonium chloride will be forced into the speaking tube, and will serve to locate the leak by its appearance wherever there is a hole in the tube.

Spectacles

Material for Spectacle Frames.—The best material for spectacle frames, as far as stiffness and strength go, is steel. A

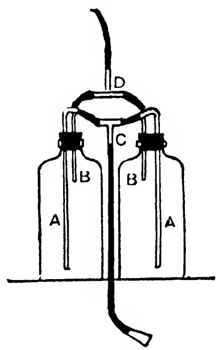


Fig. 542.—Apparatus for Detecting Leak in Speaking Tube.

good English steel frame stands a lot of knocking about, and seldom, if ever, gets bent. The secret is in the excellence of its temper. According to the "Horological Journal," it is left just hard enough to resist bending and just soft enough to keep it from being brittle. Needless to say, such a frame cannot be "adapted"—that is, its size or shape altered by bending with a pair of pliers. Next to steel comes gold; this should be as hard as possible, but it is never quite so stiff as steel. An English gold frame is generally stronger and stiffer, and possesses more spring than a foreign one. Other materials are unsatisfactory; gold-filled is as soft as copper and about as useful; nickel is both soft and brittle; while the alloys that are constantly being introduced all suffer from the same defect, softness.

Blueing Spectacle Frames.—The blue colour on steel spectacle frames is produced by hardening over a hot plate. The only other way to produce a blue colour is to paint over with a varnish paint. Black, green, or brown colour may be obtained with lacquer.

Distinguishing Gold from Gold-filled Spectacle Guards.—Gold-filled spectacle guards are now made and finished in such a manner that it becomes difficult on a cursory inspection to discriminate between them and the solid gold article. But it will be found that the screw-holders, in gold, are neither globular nor yet egg-shaped, as they may be in gold-filled; in the solid gold they are formed on a base which is squared off somewhat, and into which the eyewires are fitted by slotting, whereas in gold-filled material the holders are attached directly to the eyewires. Now that the gold-filled bars are swedged on to eyewires, the union looks from above like the strapping of the gold article, but viewed from below the ends of the bar seem partly to develop the whole width of the eyewire, spreading out a little, whereas in gold clips there is no such thickening. The loops for cord or chain also show differences, because the gold-filled cannot be so neatly and tastefully fitted as the genuine.

Fixing Cork to Spectacle Frames.—Many steel spectacle frames mark the nose; with a view to preventing this, cut a thin shaving off a cork and smear one side well with french polish, and also the underside of the bridge of the spectacle frame. Then press both into contact until the cork sets, and when thoroughly set, trim off with a sharp knife to the width of the frame.

Repairing Spectacle Frames.—The repairing of spectacle frames is described in the "Jeweller and Metalworker," which says that for repairing a broken eyepiece or nosepiece soft soldering is unsatisfactory, and the new joint soon becomes broken. Soft soldering is useless for strong repairs. Hard silver solder containing copper is the strongest for this class of work, and should be used for steel frames. Steel requires to be heated to a full red heat to cause it to unite with the solder and give strength to the joining place, and therefore hard-running solder is the best, as this is not so likely to become perished by overheating. If soft solder has previously been applied to the repair, every trace of it must be scraped or filed off before beginning the hard soldering. The surfaces of the parts to be joined together, after well cleaning, are moistened with a thick, creamy paste of borax, prepared by rubbing a lump of borax in a few drops of water, on a piece of slate. The parts to be soldered are placed together in the proper position, and secured if necessary with thin iron binding wire or iron pegs upon the charcoal block. Cut off with the shears a small piece of silver solder sufficient for the work in hand. Now by means of the gas flame and blowpipe, blow the part, gently at first, until all moisture existing in the borax paste has evaporated; then the heat is increased until it becomes red hot, and the solder flushes into the place

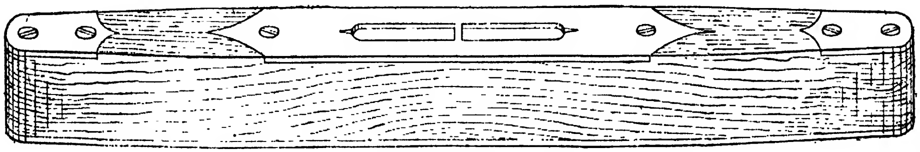


Fig. 543.—Spirit Level.

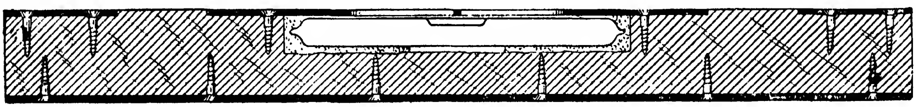


Fig. 544.—Section of Spirit Level.

intended to receive it. Be careful that both parts of the steel frame within measurable distance of the solder are raised to the same heat, otherwise the solder will only adhere properly to the hottest side, and the joint will prove weak.

Spelter (*see* Brazing)

Spirit Glue (*see* Glue)

Spirit Levels

The spirit level (Fig. 543) is used for determining the plane of the horizon; that is, the plane forming a right angle to the vertical plane. A frame firmly holds a closed glass tube nearly filled with anhydrous ether, or with a mixture of ether and alcohol. Good spirit levels are provided with a graduated scale engraved on the glass tube or on a brass or steel rule fastened to the frame beside it, so as to mark the position of the bubble, the tube being so shaped that when the level is lying on a flat and horizontal surface the bubble occupies the centre of the tube. Many levels have provision for altering the length of the bubble. Fig. 543 is a view of an ordinary spirit level, and its construction is made quite clear by the sectional view (Fig. 544). In use the level is applied to the work twice, it being reversed at the second application, and the mean of the two indications then is adopted. Spirit levels are made in many sizes and shapes, but the method of construction always is the same. A serviceable tool is of the narrow shape, about 10 in. long, its greatest breadth being $\frac{11}{16}$ in., this diminishing to $\frac{1}{2}$ in. at the ends. The frame is of any hard tough wood, such as box, ebony, lignum-vitæ, birch, beech, walnut, or oak. At the back of the tube should be silvering, which shows up the bubble and enables side lights to be dispensed with. The tube is set in plaster-of-Paris, and has a brass cover.

Choosing and Fixing Spirit-level Tubes.—Spirit-level tubes are drawn out in a blowpipe flame; the tube, with care, does not cease to be a tube, though, when twisted hot, or broken cold and placed for a moment in the flame, it is quickly sealed up. These tubes are not quite straight, but the error is not great. A tube like Fig. 545 would be quite useless, as the bubble would divide into two portions, as shown, and no indication would be possible; but if the tube is turned over (Fig. 546), the bubble promptly comes to the centre. The illustrations are purposely exaggerated. A tube that is quite straight for a portion of its length, and curves off towards one end, is very unsatisfactory; if the tubes could be uniformly larger towards the centre, as in Fig. 547, no care would be necessary in mounting. It is desirable that a tube, when set in place, should give similar indications when reversed (Fig. 547), although the surface is not level; this cannot happen unless the curvature of the tube is uniform, and the tube is uniformly set in its socket. Levels, as usually sold, are set on a tinfoil film, which makes the bubble more easily seen; in home-made levels a substitute may be employed. Mix dry plaster-of-Paris with a little powdered blue, or mix the plaster with water and blue ink; quickly set the convex side upwards, so that the bubble reverses equally at a slight inclination. An adjustable inclination is easily obtained by resting the tube on two screws inserted in the bench for a portion of their length. By this means, on reversing, the bubble ought to occupy similar positions as regards distance from the centre; then, after adjusting the screws until the bubble rests in the same place when reversed, the centre can be marked. Of course, long before this has been accomplished the plaster will have set; but that does not matter, as

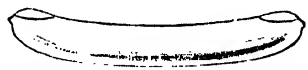


Fig. 545.—Bent Spirit-level Tube with Bubble at Each End.

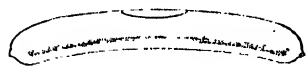


Fig. 546.—Bent Tube with Bubble at Centre.

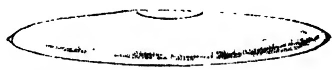


Fig. 547.—Pointed Tube with Bubble at Centre.

the under side can be adjusted by shaving with a sharp trying plane; treated thus, the level is more correct than if the tube were adjusted by the fingers. If the tube has been deeply embedded, the block containing it can be made parallel after the under surface has been adjusted.

Spirit of Salt (*see* Acid, Hydrochloric)

Splash Work

Splash work is a means of decorating mounts for photographs and pictures. The materials required are a fine brush (a cheap tooth-brush answers admirably), a fine comb, some small fresh or dried leaves, black or coloured ink, and a sheet of cardboard. To make a mount, cover over the space on the cardboard required for the photograph with a piece of clean paper, or cut it out. Place the leaves on the border, dip the brush in ink, and gently draw the comb along it, splashing the part not covered by the leaves. When the border is thoroughly well splashed, lift the leaves by means of a pin and put them away again for future use. Of course, the designs arranged with the leaves, etc., may be extremely various, and the reader's ingenuity may be exercised in the making of new and pretty patterns to suit the work in hand. Instead of a comb, a small wire frame can be made and used on which to rub the brush, but the ink is apt to clog on it. If the leaves are nicely coloured with crayons after the surrounding splashes of ink are dry, the beauty of the mount will be increased. Christmas cards mounted in this way look extremely well; and fire-screens, the covers of cigar-boxes, etc., may be effectively ornamented by splash work. Instead of fern and similar leaves, grasses may be used. This occupation trains the hand and eye, exercises the ingenuity in designing fresh patterns, and affords great pleasure in collecting leaves and grasses of different shapes and shades, which, when coloured to the real shade, give excellent results.

Spokeshaves

The simplest form of spokeshave (Fig. 548) is made of boxwood, but is not recommended, many better kinds being made entirely of iron, with screws to regulate the cutting-iron. Fig. 549 shows an iron spokeshave. In principle, a spokeshave is merely a knife or chisel edge in a suitable holder fitted with two handles. The jumping of a spokeshave may be ascribed to lack of skill, or to the following causes: loose iron; the back part of the iron touching before the cutting edge; insufficient clearance for the shavings in the mouth; cutting edge of the iron worn to an obtuse angle and requiring grinding; face of shave either too flat or too round.

Sponges

Artificial Sponges.—Artificial sponges are made in Germany by treating pure cellulose with zinc chloride. The product swells in water, and on drying becomes hard; to prevent the latter action, alkali-haloids are used when treating the cellulose. Thus, in the manufacture of the sponges, 1 part by weight of cellulose is treated with 20 parts of concentrated zinc chloride and 20 parts of sodium chloride. A pasty mass is obtained, and this is treated with 10 parts of rock salt, being then placed in a mould with pins. When removed it appears to be traversed by small canals in all directions. After having been washed in alcohol and water to remove excess of salt, the artificial sponge is ready for use.

Bleaching Sponges.—Sponges are not often bleached unless they are of a bad colour, because the bleaching process renders them more tender. The following methods are used for bleaching sponges: (1) The sponges are first soaked in a dilute solution of hydrochloric acid (1 part acid to 200 of water), and then soaked for twenty-four hours in a solution of 1 pt. of hydrochloric acid and 1 lb. of hyposulphite of soda in 20 pts. of water. After treatment, remove and wash in running water for several hours. (2) The sponges are soaked in acid as above, then in a solution of permanganate of potash (2 parts of permanganate in 100 parts of water) for ten minutes; removed, and soaked in a solution of oxalic acid and sulphuric acid (2 parts of each acid to 100 parts of water) ten minutes, then removed and washed as before. They will be very brown after dipping in the

permanganate, but they will lose their colour after dipping in the acid. (3) First wash them in clean water and then immerse them for twenty-four hours in a solution of 1 litre of hydrochloric acid in 9 litres of water. Again wash them and immerse them in a solution of 40 grammes of bromine in 10 litres of water. In twenty-four hours the blackest and dirtiest sponges will be clean. (4) Bath sponges are bleached to a pale yellow colour by the action of potassium dichromate, but for surgical purposes the chromate remaining in the sponge is objectionable. Sponges are bleached to a paler colour by immersion in a 10 per cent. solution of calcium bisulphate, and are then more suitable for surgical and cosmetic purposes.

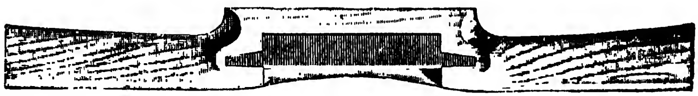


Fig. 548.—Wooden Spokeshave.

Fig. 549.—Iron Spokeshave

Cleaning Sponges.—Sponges may become clogged by the deposition upon them of insoluble soaps of lime when a hard water is used; they may also become soft and pulpy from the decay of the tissue itself. The former trouble can be remedied, but the latter cannot. A good method is to soak the sponges for twenty minutes in a warm solution of hydrochloric acid (1 part acid to 20 parts water), then remove, wash in clean water, and steep for about twenty minutes in methylated spirit; again remove, and wash. The acid, as it attacks metal, should be placed in an earthenware bowl. Sponges that get into a decomposed condition, becoming hard, gelatinous, and rotten, may be somewhat restored by being immersed a few times in water to which sufficient slaked lime has been added to bring it to the consistency of cream. Squeeze the sponge dry after each immersion. The whole process is complete in five minutes. If less lime is used, the time will be correspondingly longer. (*See also* "Bleaching Sponges" on preceding page.)

Sterilising Sponges.—The sterilisation of sponges may be accomplished by immersion for 24 hours in an 8 per cent. hydrochloric acid solution, which eliminates lime and coarse impurities; next wash them in clean water, and immerse for from five to twenty minutes in a solution of 10 grammes of caustic potash and 10 grammes of tannin in 1 litre of water. Then wash in sterilised water, or in a solution of carbolic acid or sublimate, to remove the brown colour left by the tannin. The sterilised sponges should be kept in a carbolic solution until required for use.

Spring Mattress (*see* Mattress)

Springs

Cleaning Small Wire Springs.—A good plan is to clean the springs in a barrel revolving rapidly, using clean sharp sand or emery. This will remove the rust from the springs, after which they can be brightened by finishing on a dolly with fine emery.

Springs, Hardening and Tempering (*see* main heading, Hardening).

Spiral Springs. The following easy method of making spiral springs will no doubt be found useful by many workers. Get a round length of wood, such as a broom-handle, and screw it up tight in a vice. Then bore a small hole through the centre nearest the vice sufficiently large for the wire to be pushed through. Next procure some steel wire about $\frac{1}{16}$ in. in diameter,

and cut up into convenient lengths of about 4 ft. 6 in. To coil the wire, put one end through the hole in the wood, and bend it towards the worker, allowing a sufficient length to form the hook at the near end, and proceed to coil the wire round the wood till the end of the length of wire will form the hook at the far end. Now make a clear fire with cinders, not too hot: place the springs one by one in the fire, heat to a cherry red, and cool off in oil, leaving the springs in the oil. Next take each spring out and set fire to it, allowing the oil to burn away; then drop it again into another vessel of oil. This will temper the spring, but the first one tempered should be tested.

Squeezing Wax (*see* Wax)

Staining Wood

Aniline Dyes, Using.—These are useful for staining in self-colours, and are generally employed for decorative purposes, such as inlays. Fancy furniture and nicknacks possess an individuality when thus treated, which is preferred to imitating any particular wood.

Basket Work, Staining (*see* Basket Work).

Blue.—Use indigo dissolved in dilute sulphuric acid, adding a little whiting to modify. Or use washing blue or China blue dissolved in vinegar.

Brown.—Take ¼ lb. of Vandyke brown, pennyworth of burnt sienna, 1 lb. of washing soda, and 2 qts. of water. Boil all together for twenty minutes. This stain costs about sixpence for 2 qts., is very strong, and will stain in imitation of light oak, dark oak, or walnut, according to the number of coats that are applied.

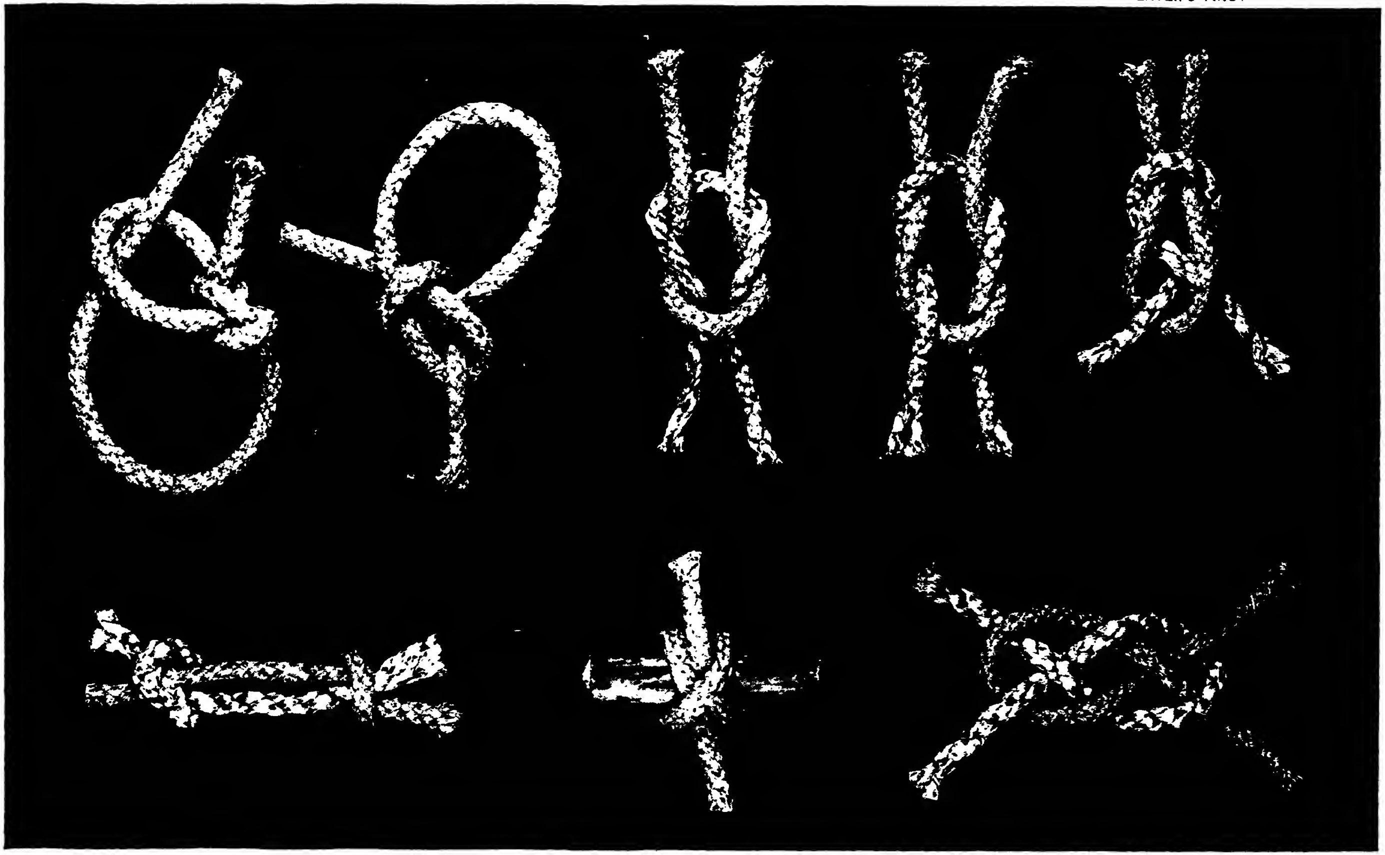
Floors.—When the staining of floors first came into vogue, the stain chiefly employed was a solution of 1 oz. of permanganate of potash to 1 qt. of water. Though purple, this dries a rich brown colour when laid, and has the merit of imitating no particular wood, whilst giving a colour that harmonises with most carpets. For further particulars, *see* the main heading "Floor."

Ebony.—(1) The usual method of staining in imitation of ebony is to coat the wood with a solution of 2 oz. logwood extract, 1½ oz. copperas, 1 qt. water, and a dash of China blue or indigo. These ingredients are boiled in an iron pot. Several coats of the hot stain are applied, then one or more coats of vinegar, in ½ pt. of which have been steeped 2 oz. steel filings or rusty nails. (2) One gal. vinegar, 2 lb. extract of logwood, ½ lb. green copperas, ¼ lb. China blue, 2 oz. nut-galls. Boil in an iron pot till dissolved, then add ½ pt. iron solution made by steeping steel filings in vinegar.

Fumigation.—This is the best method of darkening the tone of a wood, though generally it is used only for oak and mahogany. Articles are given an appearance of age or enriched in colour by shutting them up for a time in an airtight cupboard or box, on the bottom of which have been placed dishes of liquor ammoniæ; ½ pt. is generally sufficient for a box 9 ft. long, 6 ft. high, and 3 ft. 6 in. wide. It is well to have a few squares of glass inserted, through which the action of the fumes can be watched. A well-made packing-case will do, with strong brown paper pasted over the joints. This process gives shades varying from light olive to deep brown, and its chief advantage is that it does not raise the grain. To test whether any kind of wood can be darkened by fumigation, take a piece freshly planed up on one side, take the stopper out of the ammonia bottle, and lay the wood over the mouth. The vapour, of course, will be strong, and if the wood can be darkened it will very soon show a patch of altered colour. A small bit of wood will do—anything large enough to cover the bottle's mouth. For fumigation to be effective, the woodwork must be perfectly free from grease or marks of handling. A small room may be made to serve the purpose of a fumigating chamber if the precaution is taken to paste paper over all openings. Fumigated oak is generally finished by wax polishing, but there is no reason beyond custom why it may not be french-polished or varnished. Some kinds of oak are not susceptible to ammonia vapour. It is not always convenient to adopt fumigation when a like result can be gained by other means.

Green.—(1) Verdigris dissolved in hot vinegar or hot water, with a little indigo added, makes a green stain; two or three applications may be necessary. The propor-

Running Bowline Knot — Standing Bowline Knot — Reef Knot — Granny Knot — Weaver's Knot



Fisherman's Knot — Clove Hitch — Carrick Bend

KNOTS, HITCHES AND BENDS.

tions may be varied to obtain the desired tint. (2) Aniline dyes, as sold in packets or tubes for a few pence, meet all requirements, if only a small quantity—say a quart—is needed, especially if a little vinegar is added. These dyes are often preferable, owing to the facilities for getting various shades. For instance, if the green is too bright, it is easy to add a little of the blue or black dye. The hotter these stains are applied, the more deeply do they strike in. (3) Sponge the wood with a decoction of turmeric, followed by one of Prussian blue.

Mahogany.—(1) Common work, such as kitchen tables, chairs, etc., is generally wiped over with glue-size heavily stained with Venetian red, the desired tone being brought up by means of coloured polish and varnish. (2) For better-class work, wipe over first with a weak walnut stain, then a mahogany stain, which may be made by dissolving a little Bismarck brown in water or spirits; this is a very powerful pigment, and as much as will stand on a shilling will colour a pint of polish probably deep enough for general use, though more or less may be added according to the intensity desired. Strain through muslin before using. (3) Another cheap mahogany stain is made by putting 2 oz. of bruised dragon's blood in a bottle with a quart of turpentine, and standing it in a warm place; shake frequently, and use when dissolved.

Oak.—(1) One of the simplest methods of treating deal so as to obtain the dull polish seen on very dark oak is to stain it and then coat with flatting varnish. First see that the work is entirely free from glue, grease, and rough places. Stain twice with dark oak stain, softening down between each coat, before the stain dries, with a soft brush, called a badger, which will take out brush marks left in staining; do this thoroughly and quickly, as any touching up is almost sure to show. When the stain is dry, rub down with a piece of canvas, not glasspaper, which is very liable to leave white marks. The canvas can be got more easily into the hollows of columns and mouldings. In all stained work, the less glasspaper used, even in preparing the work, the better. In no case may the paper be used across the grain, as it is sure to show. Coat twice with best clear size, rubbing down between each coat. If the work is varnished with good flatting varnish, and then hard rubbed with a soft rag or piece of silk, the surface should have a nice dull gloss. (2) The following mixture allows of great latitude in shade as well as in actual colour, according to the quantity of water: Vandyke brown mixed with liquor ammoniæ, and then diluted with water, a little Bismarck brown being added to give the reddish tint required. (3) Another good stain may be made by dissolving bichromate of potash in water. By modifying this with Vandyke brown or Stephens' walnut stain, almost any required shade of brown may be obtained. Alone it gives rather too much of an orange hue. It is easy to give several applications if one is not strong enough. Apply with a brush, and allow the stained surface to turn colour by action of light and air.

Walnut.—(1) Take 1 pennyworth nut-galls, 1 pennyworth Vandyke brown, ¼ lb. American potash, and 1 gal. water. The nut-galls should be crushed and mixed with the potash, and the water added hot. The stain may be used hot or cold. A little brown umber may be included in the mixture if desired. (2) Mix Vandyke brown, or equal parts of this and brown umber, into a thin paste with liquor ammoniæ; thin down to the required tone with water. Ammonia is not an essential, but it is desirable; the smell soon evaporates, and it can hardly be objectionable if the stain stands for a few days before using. Caustic soda or potash may be used instead of ammonia, but against these substances objections may be urged.

Yellow.—(1) A yellow finish on wood can be obtained by staining and sizing at one operation, yellow ochre or lemon chrome being mixed with patent or glue size, and applied warm with a brush, the surplus being wiped off with a piece of rag. When dry, rub smooth with fine glasspaper, and finish with spirit or oil varnish. (2) Mix raw sienna with water and dissolve a little size in this mixture. Then, with a sponge, rub the mixture into the work until it is evenly coated. Rub nearly dry. When thoroughly dry, varnish with hard-drying church oak varnish.

Stains, Removing (*see* Cleaning *and names of articles*)

Staircase, Papering (*see* Wallpaper)

Stalactites, Polishing

In polishing stalactites and similar stones, there is no false gloss put on, as in french polishing, the surface of the stalactite being merely made smooth. Having decided which part of the stone to polish (it should be the one which will exhibit the formation of the stone), all irregularities are rubbed out on an ordinary flagstone and silver sand, using plenty of water; and when all holes, etc., are well rubbed out, wash and dry the stone. It can then be seen whether the surface is anything like smooth; if not, continue the rubbing. The better this part of the work is done, the easier will be the next steps. When no more can be done with the silver sand, rub the specimen with a piece of second grit-stone, to remove all scratches made by the sand, and then rub with a piece of snake-stone or water-of-Ayr stone. The surface should now be perfectly smooth, but minus a gloss or brightness. To impart this, rub it well with a damp piece of an old stocking on which has been sprinkled a few grains of oxalic acid. The surface of the specimen should now have a dull face; to finish, a little putty-powder and a very little salt of sorrel are used in the same way as the acid. Marble polishers use polishing-felt instead of the old stocking. Marble may be polished in the same way, but some varieties will require spirit of salt to be used with the putty-powder instead of the salt of sorrel.

Stamps (*see* Indiarubber)

Starch

Ordinary starch for linen usually is the same whether made with hot or cold water; but used cold it does not give such a stiff finish as the boiled. Starches for sizing are so made that they break down even in cold water; these, of course, are different from ordinary starch. The usual starches sold for laundry purposes are maize (Indian corn) starch and rice starch, and for sizing purposes potato starch and sago starch. Starch is made from potatoes by rasping and washing them through fine sieves; the starch separates from the wash waters and, after several washings and settlings from pure water, is drained, dried slowly, and broken up. The following is an outline of a largely used process for preparing maize starch. The grain is steeped for three days in warm water at a temperature of 60° C., and a small quantity of bisulphite of lime or other preservative is added to prevent fermentation. The wet grain is then ground between rollers and passed to shakers, which are long cloths stretched on frames kept in constant motion. The shakers act as sieves, allowing the fine material to pass through, while the coarser material is kept back and put through grinding rollers again. The liquid containing the starch in suspension falls through the shakers into large vats which, being conical at the bottom, are called settling cones; in these the starch is allowed to deposit and the water is run off. The wet starch is next run into mixing vats, a large amount of water added, and also a small quantity of alkali to neutralise the acid generated. The starch is allowed to subside, then is run on to tables and the water run off; a second washing with water, followed by subsidence, is usually given to remove the impurities. The purified wet starch is run into wooden boxes, made slightly taper and with a perforated bottom to allow of drainage. After draining, the starch slabs are emptied on to a table, from which the remaining water is removed by a vacuum pump, and the blocks of starch are loaded on trucks containing shelves and then run into drying kilns. These are built of wood, and hot air is drawn over steam pipes right through the kilns by means of a fan. There are also subsidiary operations connected with the removal and treatment of the germ and oil, which now are also valuable products.

Black Starch.—This is used in many industries; to make it, add logwood extract to ordinary white starch before boiling. A weak solution of potassium bichromate in hot water or a small quantity of black iron liquor may be used to bring out the shade of black, which will vary with the amount of logwood used.

Starch Gloss.—Mix together 7 parts of powdered borax, 2 parts of starch, and 1 part of pulverised gum arabic.

Steam Boilers (*see* Boilers)

Steatite (*see* Talc)

Steel

Bronzing Steel (*see* Bronzing).

Cracks in Steel.—To detect cracks in steel tools, dip the tools in paraffin, rub the surfaces clean, and wipe over with chalk. The paraffin will, after a time, sweat out from the cracks on the chalk, and leave visible lines.

Dead Polish on Steel Articles.—A fine, polished, lustreless surface can be produced on tempered steel by either of the following methods: After the steel has been tempered, it should be rubbed on a surface of smooth iron charged with pulverised oilstone until it is perfectly smooth and even. Then it is laid on a sheet of white paper, and rubbed backwards and forwards until it acquires a fine dead polish. Holes or depressions in the steel must be cleaned beforehand, and polished with a piece of wood and oilstone. A more durable surface is obtained by smoothing the steel surface with an iron polisher and some powdered oilstone, and carefully washing and rinsing. Then, in a small vessel, mix some fresh oil and powdered oilstone; in this mixture dip the end of a piece of elder-pith, and polish the steel surface with a gentle pressure, cutting off the end of the pith as it becomes soiled. After this treatment the steel should be thoroughly cleaned in soft water, when it will be found to have a fine, white, lustreless polish.

Gilding Steel (*see* Gilding).

Hardening and Tempering Steel (*see* Hardening and Tempering).

Oxidising Steel (*see* Oxidising).

Polishing Steel.—Wood wheels, covered with buff leather, on which emery powder is fixed with best glue, are used for polishing steel. Emery powder of graded qualities, finishing with putty-powder and whiting, are the materials. A good polishing composition for steel may be made of 3 parts of flour emery powder and 1 part of crocus mixed in best mutton suet heated to boiling point, then left to cool. For metal polishing, make a mixture composed of rottenstone, 3 parts, and crocus, 1 part. (*See also* Metal Polishes.)

Rusting of Steel (*see* Rust).

Wilder's Coating for Steel and Iron.—This is a good substitute for ordinary galvanising, which it resembles. The resultant coat of metal, it is claimed, is superior to any other known, adheres to the sheets, will withstand working, resists corrosion, and can be heated to redness without injury. The process consists in dipping the cleansed sheets in a melted alloy of zinc, 84 per cent.; tin, 14 per cent.; lead, 1·5 per cent.; and aluminium, 0·5 per cent.

Steel-wool

Steel-wool, the glasspaper substitute, was introduced into America probably between 1890 and 1894, and consists of sharp-edged threads of steel which curl up like wool fibres and which are so fine that they are but little coarser than the coarsest of natural wools. Steel-wool is put up in 1 lb. packages, which resemble rolls of cotton batting but are smaller, each being about 15 in. long by 2 in. or 3 in. in diameter. It is machine-made in many degrees of coarseness, the finer being used for polishing woods, and the coarser for rubbing down paint and varnish. It is specially suitable for curved work, and whilst for the panel of a door ordinary glasspaper stretched over a cork or wooden block might be used, the steel-wool would be found more convenient for the mouldings, as it takes the shape of the work for the time being. The action is quicker than that of glasspaper. A coarser material than the wool is "steel shavings," the many uses of which include the removal of old paint and varnish, smoothing rough wood preparatory to painting, and smoothing floors. Workers using the new material wear gloves to prevent it sticking in the fingers, and whilst glasspaper wears out, steel-wool breaks down.

Sticks (*see* Walking Sticks)

Stockholm Tar (*see* Tar)

Stocking, Elastic (*see* Elastic Stocking)

Stone

Cement for Stone.—(1) There are several cements suitable for joining stone that will show no stains. Chloride of zinc mixed with oxide of zinc to the desired consistency sets hard in a very short time. Magnesium chloride mixed with magnesia is also remarkably good, and is used by sculptors. Silicate of soda mixed with a very little water, and having slaked lime stirred into it, is also effectual for the purpose. Any of these may be stained to the colour of the stone by adding a little yellow ochre. (2) The proper cement for bedding and pointing stonework consists of 3 parts of stone-dust and 1 part of Portland cement. The colour of the cement should be the same as the stonework, whether Portland, Bath, Ancaster, or any other. (3) The shellac cement used for uniting stone is usually the ordinary shellac softened by heat and drawn out into sticks. Sometimes a small proportion of Venice turpentine is melted with the shellac for the purpose of softening it and rendering it less brittle. It has been stated that two pieces of stone to be joined should be heated with a hot iron, shellac sprinkled on till melted, and the two pieces put together while hot. Now, to heat stone till hot enough to keep shellac melted till joined would mean ruin to the stone, turning it a dirty brown colour, particularly at the edges, and the two pieces would have to be very quickly applied before the shellac set, as well as making a very unsightly joint. The following is a better method. For light-coloured building stones, white marble and white alabaster, take 8 oz. of bleached shellac, dry thoroughly and bruise fine, and dissolve in 1 pt. of methylated spirit, shaking occasionally. Give each piece of stone to be joined a coat of this, after five minutes' interval another, and if very porous, yet another. Press them together so as to squeeze as much shellac out as possible, then put a weight on or bind round with string till set. For red building stones, veined marbles, or alabaster, use brown shellac in the same manner. If for stone with chipped arrises or lost corners, powder a piece of the same stone to be mended, and mix to a very stiff paste with the dissolved shellac. Give the damaged parts one or, if porous, two coats of the solution, and apply the mixed dust with a flat piece of wood, rubbing into shape with the same. When nearly dry or just tacky, sprinkle on a little of the dry dust, and press down with the piece of wood as before. This last layer of dust must be very thin, or it will weather out and show the joint in a short time. The shellac which runs out of the joint through pressure, etc., must not be wiped off, but allowed to set. It can then be rubbed off with a piece of stone and water, and if properly done will show a very neat joint, hardly noticeable. A piece of cornice, part of an under drip nose, has hung for more than forty years, being stuck on in the way above described.

Cleaning Stone Mantelpiece.—The dirt can be removed by rubbing with sand and water, and then thoroughly washing with clean water. Soap or soda used along with the sand will help to improve the appearance. If, however, the existing surface is merely to be covered with material which will not rub off, try an application of a solution of silicate of soda first, and then a wash of lime; after glasspapering, another wash of silicate will bind the whole. First of all try an experiment upon a piece of stone to see if the above treatment is suitable.

Cleaning Stone Steps.—For Portland or Painswick stone, pipeclay should answer well, but should be sparingly used, just a smear being rubbed on evenly with a wet rag. Or a piece of soft Bath stone (Corsham or Farleigh Down for preference) might be used; it should be rubbed on with a little water and finished with a wet rag. The mistake that is generally made is to put on too much of the whitening material, hence it flakes off in places and has generally a rough appearance.

Stone Cutting and Polishing

The following instructions on cutting and polishing carnelians, or cornelians, are equally applicable to other stones of a medium degree of hardness, such as agate, amethyst, aquamarine, beryl, blood-stone,

Brazilian topaz, carbuncle, cat's-eye, chalcedony, chrysolite, chrysoprase, crystal, elvans, emerald, felspar, flint, fluor-spar, garnet, heliotrope, jade, jaspar, lapis lazuli, mina nova, onyx, opal, paste gems, peridot, plasma, porphyry, quartz, sard, sardonyx, serpentine, and topaz. First, the rough carnelian is slit on the slitting mill, which is a thin iron plate revolving at a moderate speed round a vertical spindle, the edge of the slicer being charged with diamond dust and plenty of the lubricant—oil of brick. The carnelian is slightly pressed against the edge of the slicer. The second operation is rough-grinding on a lead mill which resembles the slitting mill, except that the revolving table is of lead. The carnelian is moved to and from the centre of the rapidly revolving lap, which is fed with coarse emery and water, until the marks made by the slitting mill are removed. The coarse emery marks are removed on the lead mill with flour emery, and then, in the case of stones not smaller than $\frac{1}{3}$ in. in diameter, the polishing is commenced on a hacked or jarred lead lap, the abrasive material being rottenstone moistened with water; rottenstone would not adhere sufficiently to a smooth polishing-lap. The lap is hacked or jarred by holding an old table-knife blade near the middle between the thumb and finger, the knife-edge resting on the lap at something less than a right angle, so that the knife meets the lap edge foremost when the lap is revolved. The knife is held very slenderly, so that it is caused to jump and vibrate, and thus make a series of slight grooves or furrows in which the finely powdered rottenstone can lodge. The wheel afterwards is revolved in the opposite direction, and cross grooves are cut. If the stones have a diameter less than $\frac{1}{3}$ in., and if they are rather hard, pewter polishing-laps are used; copper laps are employed for the smallest and the hardest stones, but in all the cases the laps require to be hacked and fed with powdered rottenstone and water. Rounded or convex stones may be worked with emery on a wood mill, then with pumice-powder on a list mill, and finally with putty-powder on a leather lap. These laps have greater elasticity than the metal ones, and are more suited to the globular forms of stones. To cut facets, a lead wheel with emery, and then a pewter wheel with rottenstone, are employed; for harder stones, a copper lap replaces the pewter one. Small stones, which cannot be held in the fingers, are cemented centrally in the end of a wooden stick. By holding the stick vertically over the lap, the "table" or central facet of the stone is cut; the stick is inclined to certain angles for the eight, twelve, or more facets contiguous to the table. Two, three, or four series of these facets generally are required at different inclinations. The horizontal position of the stick serves to cut the girdle or central band around the exterior edge of the stone. The correct inclinations of the stick are found by placing its upper end into one of several holes in a fixed vertical post.

Stove-enamelling (*see* Enamelling)

Stoves

Black Varnish for Grates and Stoves.—In the spring, when fires are dispensed with, it is a custom in many homes to coat the grates, stoves, fenders, and other ironwork attached to fireplaces, with Brunswick black, in order to save the trouble of constant blackleading. This gives a bright, glaring appearance, and in some instances presents a surface that is difficult to blacklead again. This is more difficult if the blacklead is mixed with turpentine. A varnish free from both objections may easily be made as follows: Dissolve 4 oz. of common shellac and 2 oz. of resin in 1 pt. of methylated spirit, and add $\frac{1}{2}$ oz. of black aniline dye, soluble in spirit, to give it a rich black colour. Should there be any difficulty in obtaining the dye, gas black may be used. This can be bought cheaply, or it can be obtained by boiling a pot or kettle over a gas burner, hanging it so that it nearly touches the burner. The fine jet black which forms at the bottom of the pot or kettle should be removed when cold, and mixed with the varnish—sufficient to give it a good black colour. The above gives a fairly bright surface, which can be dulled by omitting the resin or re-

ducing the quantity. It should be applied with a camel-hair brush. However, it may be stated that a spirit varnish is generally considered unsuitable as a stove black. Perhaps a better spirit black is prepared as follows :—Place $1\frac{1}{2}$ lb. of gum sandarach, $\frac{1}{2}$ lb. of shellac, $\frac{3}{4}$ gal. of methylated spirit, and $\frac{1}{4}$ gal. of fusel oil in a suitable vessel, and agitate at intervals until all the ingredients are thoroughly dissolved, then add 2 oz. of brilliant spirit black ; this mixture, after being passed through a fine strainer, is ready for use. The following is a simple method of preparing a good stove black : Melt 8 lb. of asphaltum in a suitable vessel over a fire, then add 1 gal. of boiled oil which has been previously heated, and 1 lb. of litharge, and boil for half an hour, continually stirring. Now remove the pan well away from the fire and allow to cool somewhat, then add steadily 4 gal. of American turpentine ; stir well, and pass through a fine strainer while warm ; allow the mixture to stand about fourteen days, when it is ready for use. This varnish dries with a good gloss in about four hours, and is suitable for stoves and ornamental ironwork.

Cementing Joints Round Cooking Ranges.—A cement that will not crumble and break away around the front edges of range covings cannot be obtained. The heat appears to affect the cement, but the real cause is the expansion and contraction of the range parts when heating and cooling. A slow-setting cement might be used, so that when the fire was lighted the range parts and cement would accommodate themselves to each other. If care is taken to keep the joint very small, common glaziers' putty could be used ; this answers well, as it eventually hardens with the heat. But better still will be to have the stone jambs tight up or overlapping the edgings of the covings ; or get the range maker to provide a moulded edge up each side and across the top of the range to overlap the jambs and frieze. To keep cements in good condition all moisture and air must be excluded.

Cleaning Rusty Stove.—If possible, the stove should be taken out, taken apart, and the flat ground portions rubbed down with emery cloth, finishing off with fine emery and oil. The mouldings should be cleaned in the same way, and burnished or polished with fine emery powder and oil, then finished off with putty-powder. If the grate cannot be taken out, rub as bright as possible with emery cloth, and finish off with finest emery powder and oil.

Gas Stoves (*see* Gas).

Oil Stoves (*see* Oil).

Petrol Stoves (*see* Petrol).

Repairing Cheek of Stove.—If the cheek is of firebrick, then any attempt to repair a hole with fireclay will be unsuccessful ; the proper thing to do is to replace the burned firebrick with a new one. If the cheek is an iron one, forming part of the stove, then any hollow space may be filled up provided the space will take a cement material. A better preparation than fireclay for repairs of this kind is Purimachos, which resists fire very successfully. A home-made cement, said to be unaffected by fire heat, can be made up of 1 lb. of iron filings, $\frac{1}{4}$ lb. of finely pulverised glass, 1 oz. of plaster-of-Paris, and 1 oz. of powdered gum arabic. These are mixed and kept in a dry state, and made up into a cement with water when required.

Stove Polish.—The commercial varieties of paste blacklead, or stove polish, usually have poor keeping qualities, a hard cake frequently turning out of the tin when opened. A thrifty householder can manufacture his own stove polish at a merely nominal cost, and thus be certain of its freshness and quality, by mixing 8 oz. of powdered blacklead (plumbago) and about 1 oz. of soft soap with a little water into a paste of the required consistency. The plumbago may be purchased for about 4d. per pound and the soap for even less. When a grate or stove has become greasy, and consequently difficult to clean, a good rubbing with a slice of raw onion will often render the subsequent polishing a comparatively easy matter. A new recipe for a stove polish is to heat treacle to about 250°. This should be done in a steam-jacketed pan if possible, but, failing this, a saucepan may be used on a kitchen range hot-plate, provided that an asbestos mat (obtainable at any ironmonger's) is placed beneath. The treacle must be a clear kind. When it is heated sufficiently, stir in as much

plumbago as it will possibly take. Good mixing is required, grinding being customary when possible. If care is taken to keep water or steam from this paste, it will keep as well as any. Bone black, carbon black, or a little aniline black can be added if a deep black is required.

Straw

Bands or Rope.—Where short lengths only are required, say up to 20 ft., the straw bands are best twisted by hand. To do this, a simple twisting hook, as shown below, is needed. It consists of a piece of stout iron wire bent to form a handle, as in Fig. 550. Two pieces of ash, oak, or chestnut, 8 in. long, are cut from a dry faggot and bored to take the wire. One of these pieces is pushed on the shorter end of the wire, which is burred over a washer, keeping the wooden handle in place. On the longer end put an old iron nut, a washer, and the other piece of wood; then bend the end to form a hook, as shown in Fig. 551. A hook clamped in the jaws of a carpenter's brace would answer the same purpose. To make a band, the straw must be well wetted and lightly tossed up in a heap; the operator, standing with the heap on his right, puts the bight of a wisp over the hook, which is to be turned by a boy. Some skill is essential in feeding the twisting band, which passes through the left hand while the right keeps adding fresh wisps. When twice the length required has thus been twisted, the centre is thrown over a stake previously driven in the ground; the boy, keeping a strain on it, gives his end to the man, takes up the centre bight off the stake, and with his hook twists in the opposite direction. When long lengths are required, a "jenny" is necessary; this is an arrangement of cog-wheels by which two, three, or four strands can be twisted separately, and together, as the outer wheels are thrown in or out of gear. The machines can be bought at ships' stores; they are used for making marline, spun yarn, and nettle stuff at sea.

Bleaching Straw.—Straw may be bleached by boiling it first in a solution of washing soda, next, after washing in water, steeping in a solution of bleaching powder (chloride of lime), and then in a solution of bisulphite of soda, finally washing with water. If to be treated on a large scale, boil the straw in a solution of washing soda, and, whilst still moist, submit it to the action of sulphurous acid. To do this, the straw must be hung in a nearly closed chamber; a box or barrel will do, if only a small quantity of straw is to be bleached. A piece of roll sulphur is placed on a saucer and ignited with a hot iron rod; the saucer is then placed in the chamber (below the straw, but not too near it) and left burning for some time. After bleaching, the straw should be washed with warm water to remove excess of sulphurous acid.

Cementing Straw to Paper.—Try a solution of 1 oz. each of glue, gum arabic, and brown sugar in 6 oz. of warm water;

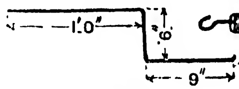


Fig. 550.

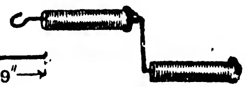


Fig. 551.

Figs. 550 and 551.—Hook for Twisting Straw Bands.

or place about 1 oz. of gelatine in a wide-mouthed bottle, cover it with moderately strong acetic acid, and, next day, melt it down by a gentle heat. These cements must be melted by heat before use.

Straw Hats (*see* Hats).

Strawboard

Pulping Strawboard.—Boil the strawboard with water in a pan provided with some kind of stirrer or beater to keep the pulp from settling on the bottom of the pan and also to break up the pulp when it becomes soft.

Waterproofing Strawboard Pulp.—After beating the strawboard pulp till it is thoroughly disintegrated, add to it common soap dissolved in hot water, and immediately after a solution of alum; this will cause the precipitation of an alumina soap, and if the beaters are kept in action during the addition of the alum, the insoluble soap will be deposited equally all through the fibre; the mass will then be easily moulded,

and will be waterproof right through if sufficient of the materials be used. The ratio of alum to soap is about 1 to 3, but sufficient should be added to destroy all appearance of a lather. A harder and cheaper material may be made by saponifying ordinary resin with soda ash, and precipitating the resin soap upon the pulp with alum in the same manner as described above. The proportions of the various ingredients can easily be worked out by experiment. It may be worth while, however, to try the ordinary soap first, this being far the simpler plan.

Stylograph (*see* Fountain Pens)

Sublimate, Corrosive (*see* Mercuric Chloride)

Suint (*see* Wool Grease)

Sulphuric Acid (*see* Acid)

Sunflower Pith

Sunflower pith is regarded as the lightest solid in the world. It is the purest natural form of cellulose obtainable. There is only one way in which to secure the pith in the state of purity: when the sunflower plant has ceased flowering, allow the stalk to remain in the ground for one to two weeks, not longer; then with a knife slice away the bark, so that the pith is separated with as little bark or fibre as possible. By these means it is feasible to obtain pith 3 ft. to 4 ft. long and $\frac{3}{4}$ in. to 1 in. in diameter. If the stalk be left too long in the ground after the flower, etc., has withered, the pith becomes hollow and of a brownish colour; while if the stalks are cut down and allowed to lie on the ground before separating the bark, then the pith also withers or shrinks up and decays. The best time to secure the pith is while the sap is still in the stalk.

Sword Belt, Renovating

Thoroughly clean all brasswork, burnish every part, and brush out every crevice; then free them from all traces of oil or grease. Get some good gold lacquer and a camel-hair varnish brush. Make the brass too hot to be held in the hand, then apply the gold lacquer in even strokes in one direction—one coat only over all the surface. Dry away from dust in a warm place. This will be superior to gilding if done well, as directed. When soiled or wet, do not rub or wash the lacquered surface, but dab it with a moist sponge and dry in a like manner by dabbing with linen rags. The glossy black on the leather and scabbard is jet varnish, made by dissolving black sealing-wax in warm spirit of wine. Put this on in a thin even coat on the clean dried leather. If put on too thick, the jet varnish will probably crack when the leather is bent.

Syringe for Dusting

A blow syringe for dusting may be made from a discarded cycle pump. Such a syringe is particularly useful for removing dust from the piano, its shape making it much more convenient than the bellows commonly used, and the cost being much less. In printing offices it would be serviceable for cleaning the dust from the cases. The casting at the lower end of the pump is removed by unscrewing it from the tube. The top of a cheap zinc oil-can is then cut off at the proper place to make a good fit for the end of the pump, and soldered to the narrow collar that will be found thereon. In cutting off the top of the oil-can, leave about $\frac{1}{4}$ in. extra metal to form into a shoulder to fit inside the collar, making the work of soldering an easy matter. Ordinary soft solder may be used, with resin as a flux. The oil nozzle should be removed while soldering to the tube to avoid bending it. It may also be found necessary to file off a small part of the outer end of the nozzle, if a small one is used, to allow a larger volume of air to pass when using the pump.

T

Tables

Bagatelle Table (*see* Bagatelle).

Bamboo Table (*see* Bamboo).

Covering Table Top with Leather.—For covering a table top, a heavy duck-lined American leather will be suitable; this can be purchased in all colours and widths. A roan skin would make a splendid covering, and would cover an ordinary table top in one piece, as the sizes run up to 38 in. wide, and being very elastic and supple, no difficulty should be experienced in laying the skin. To prevent damaging the leather top, the beading round the borders should be stained or polished first, or at least french polished as far as bodying up, the spiriting off being done afterwards. For sticking down the leather, use a well-boiled rye-flour paste, or equal quantities of glue and wheat-flour paste, spread on with a broad knife. The leather is cut 1 in. larger each way, and the top well rubbed with the paste. The leather is laid on and the smoothing begun from the centre and worked to the edges; this should be continued until all wrinkles and pleats are removed, when the edges should be carefully trimmed to the beads with a thin-bladed knife. A rubber squeegee, as used by photographers, will be very useful for laying the leather. Heat would be necessary for heating rollers for embossing the borders. American leather is very unsuitable for gold embossing. Roan skins can have any amount of decoration. Or the borders can be lined with a gold-edged chain banding, which can be bought in several colours ready for use. Another method of covering would be to take off the beads and cover the whole surface, then glue down the beads on the top of the leather covering.

Tailors Crayons (*see* Crayons)

Talc

Talc is a natural product, and it cannot be made artificially. There are two substances sold under the name of talc. The real talc is a laminated mineral easily split up into thin plates, which are flexible but not elastic, and usually dark coloured or black. This mineral is a hydrated silicate of magnesia. Two varieties of talc, which are very different from this in their properties, are steatite or soapstone, and french chalk. These two minerals occur as soft massive rocks; the former has a slippery or soapy feel (hence the name) and a bright scaly surface, the latter being a soft earthy rock somewhat like clay, but smoother to the touch. The other mineral sold as talc is really mica, a mineral occurring in granite, sometimes in the form of large crystals, which can be split up into extremely thin plates. It is usually colourless or pale coloured, the colours being yellow, orange, brown, green, etc. The mineral is transparent in thin films, and is both flexible and elastic. Mica is a silicate of alumina and potash.

Hardening French Chalk (Talc).—French chalk may be hardened by mixing it with 10 to 20 per cent. of china clay or fireclay. This mixture, if tempered with water and worked about until perfectly plastic and homogeneous, can be moulded, and the articles dried and burnt in a suitable kiln.

Tallow

Deodorising Russian Tallow.—The odour of Russian tallow may be disguised by adding a powerful scent such as nitro-benzene (oil of mirbane); it may also probably

be removed by melting the tallow in a water bath, heating it for some time with animal charcoal and filtering. If desired, Australian tallow may be used instead of Russian tallow; it is quite as good, and it is usually perfectly fresh and sweet.

Distinguishing Good from Bad Tallow.—A good tallow will be hard and white, with but little smell, and not easily melted; but, when melted, it will be quite clear. A bad tallow will contain floating dark particles or be quite opaque when in the melted state. The purity of a tallow is determined by tests, as follows:—(1) Specific gravity. (2) Melting point. (3) Iodine equivalent. (4) Acidity. (5) Insoluble fatty acids. (6) Volatile fatty acids. (7) Mineral matter.

Rendering Tallow.—For rendering tallow and fats, the method now almost universally adopted is steam heating; by this the temperature can be better regulated than in any other way, and the whole mass in the pan is subjected to an equal heat. Fire rendering is only used for small quantities of fat, the expense of fitting up special plant not being justified, but this method does not produce such a white product as when steam is used. For rendering tallow with an open fire, the pan should be moderately shallow and set in brickwork in such a way that the sides as well as the bottom of the pan are heated. A hemispherical iron pan similar to a washing copper may be used, but should be supported either by an iron plate with a round opening to fit it, or else by a couple of bricks just over the firebars, leaving the remainder of the pan in contact with the hot gases from the fire; by fitting the pan in this way it will be much more regularly heated, and the tendency to burn the fat or membrane will be much less. In rendering, sometimes 1 or 2 per cent. of sulphuric acid is added, but such treatment necessitates subsequent washing of the fat and a second heating to remove the water. It is usual to filter the fat, and this may be done by passing through canvas bags in a warm room; on the large scale the filter press is used.

Varieties of Tallow.—Russian tallow is rendered from beef fat in Russia. It is considered a high-class tallow, and at one time commanded a high price. It is somewhat rancid, and has a peculiar odour. There is not a great deal of difference in the various kinds of tallow, but some are more easily melted than others. They are usually sold to the candle maker for the preparation of fatty acids, and their value is in proportion to the melting point of the fatty acids they contain. The various kinds of tallow are: Town tallow (rendered from kitchen fat), Russian, North American, South American, Australian, New Zealand, and Cape.

Tanks

Prevention of Rust in Galvanised-iron Tank.—If rusting has already begun, the only method of preventing further rust, short of having the cistern re-galvanised, is as follows: Empty the cistern and clean the rusted parts as well as possible. When quite dry, give the surface a thin coat of limewash, well rubbed into the rusted parts. When dry, give another coat of limewash. When the second coat is dry, the water may be run into the cistern. The limewash is made by mixing newly slaked builders' lime with water to the consistency of thin cream, adding a little size to act as a fixative.

Tarring Water Tank.—Suitable proportions will be 1 part of pitch and 3 parts tar; should this be found somewhat tacky, increase the quantity of pitch. This should be heated till the pitch is melted and well stirred in, when the mixture will be ready for use. There is no necessity to boil the materials for a great length of time, as this would mean loss of volatile ingredients by evaporation from the tar; long boiling will make the material harder, but this result can be obtained by increasing the proportion of pitch.

Tanning

Tanning Nets, Lines, and Sails.—(1) To bark or tan fishing nets, lines, and sails, first get a pot large enough to hold sufficient water to cover the net. Add to the water 4 lb. of cutch (catechu) or bark. Put the pot over a fire, and boil the mixture for two hours' hard boiling. Then

put in the net and leave it in the solution for two days—that is, for a new white net. Next take out, and allow it to drip and dry in the sun (not in the shade) for one day. This enables the cutch to take a fast hold, while sunshine fastens the tannic acid. After a fortnight's use, bark again, but this time only allow it to lie in the solution for about one minute, then take it out, and drip again. Fishing lines are dipped in the solution for about one minute only, and may then be hung up to dry. For the foresail of a large herring-boat, boil 20 lb. of cutch in as much water as will wet the whole sail. Spread the sail on the ground, carry the cutch in pails, and throw the hot cutch on the sail, rubbing it in with brooms or brushes, back and fore, until all is done. Turn the sail on the other side, and repeat the operation. Afterwards, fold the sail up, let it lie over-night, and spread out to dry next day. Some fishermen add 7 lb. of tallow, 7 lb. of Archangel tar, and 7 lb. of red ochre to the cutch, boiling all together, if the sail is very old; but the general way is to use only the cutch and water. A method advised for the small sail of a pleasure boat is to put 4 lb. of cutch in the pot with sufficient water to wet the sail thoroughly, and to spread out and rub on with brushes, roll up over-night, and spread out to dry next day. Cutch can be had from ropeworks, and from some ironmongers and fish salesmen. It may be said that a solution of cutch (catechu) is really a solution of tannin or tannic acid, for which most fibres seem to have an affinity, and they will remove it from solution; but in the case of cotton, linen, and other cellulose fibres the affinity is not so great, and water will gradually dissolve it out again, hence the nets will lose it in time. The rich brown colour produced on exposure to air is an oxidation product of unknown composition, but allied to the humus of peat; it is formed rapidly in an alkaline solution, for instance, in presence of ammonia or carbonate of soda. If the fibre is steeped in a tannin extract and then in a solution of alum, copper sulphate, lead acetate, or ferrous sulphate, insoluble tannates of these metals are deposited, especially when subsequently dipped in a weak soda solution. These tannates have probably more preservative effect than the tannin itself. Tannate of iron gives bluish-black, which is a true ink. (2) Wet the nets thoroughly in water, dissolve 10 per cent. catechu in a separate vessel, add sufficient water to cover the goods, and then immerse the nets. Leave overnight, and next day remove the nets and immerse in a lukewarm bath containing 4 per cent. bichromate of soda or potash, and work about in this for half an hour. The nets can then be washed, and dried in the open air, when they will be of a nice tan, or brown, colour. The percentages are calculated on the weight of goods. The following precautions should be observed:—Thoroughly wet first, and then squeeze out excess; use no more liquor than is necessary to cover the goods; and do not wash after the first bath. (3) If nets and sails are allowed to lie on a heap while wet, they will become mouldy, and will tear like brown paper. They should be turned over every day, letting the fresh air get between the folds. If there is not time to dry them thoroughly, the following treatment is easier and quicker than tanning. Take 1 lb. of alum, 1 lb. of salt, and $\frac{1}{2}$ lb. of chrome alum, and scald in 2 gal. of water. When cool, allow the goods to remain in twenty-four hours, lifting them in the liquor three or four times. This liquor can be used again, after adding half the quantity of fresh ingredients to strengthen it.

Tanning Pig's Skin.—Soak the skins in tepid water for two hours. Mix equal parts of borax, saltpetre, and Glauber's salt (sulphate of soda) in the proportion of $\frac{1}{3}$ oz. of each for each skin, using sufficient water to make a thin paste. Spread this thickly over the inside of the skin, then double the skin flesh inwards, and lay it aside in a cool place; after twenty-four hours, wash the skin clean, and apply, as before, 1 oz. of sal soda, $\frac{1}{3}$ oz. of borax, and 2 oz. of hard white soap melted together without raising to the boil; then fold again, and put in a warm place for twenty-four hours. Now dissolve 3 oz. of alum, 7 oz. of salt, and $1\frac{1}{2}$ oz. of saleratus in sufficient hot rain-water to saturate the skin. When the solution is cool enough to allow of the

hand being placed in without scalding it, soak the skin for twelve hours; then wring it and hang out to dry. When dried, repeat the soaking two or three times till the skin is quite soft. Smooth the inside afterwards with glasspaper and pumice-stone.

Taps or Cocks

Cleaning Brass Water Taps.—The old-fashioned way of cleaning water taps was to use sweet-oil and rottenstone. Brooke's Monkey Brand Soap and Globe Metal Polish are good. Bath brick dust or emery paper should not be used, as each scratches and wears away the brass. A high polish can be produced by rubbing with a steel burnisher or with some of the compositions that are sold by ironmongers for cleaning brasswork.

Fixing Taps in Urns.—If it is not possible to use a nut on the tail of the cock with a good rubber washer, try either plaster-of-Paris mixed with a solution of gum arabic until it is a stiff but sticky paste; or plaster-of-Paris and alum well mixed with hot water. If the tap fits loosely in the hole in the earthenware lining, a small hard-wood collar should be turned to fit the hole closely, and also to fit the tapering end of the tap. Then insert the tap, and form a cone-like layer of plaster-of-Paris around the joint to render it sound. If the tap fits closely, no wood collar is necessary.

Grinding Plug Cock.—(1) Re-grinding the key into the barrel is a delicate operation for which considerable skill is required. The first thing is to file down the projecting parts of the key, using a very fine float file, then fix the head of the key in a vice, rub a little wetted loamy grit on the key, and, by hand, rotate the barrel to and fro on the key, until the latter has the same appearance all over, thus showing that it accurately fits the barrel. If the key is much worn it may be necessary to file down the square shoulder on the bottom end, or to make and fit a new and thicker brass washer, to allow for the further entry of the key into the barrel. It is wise to practise on cocks of little or no value before attempting to grind in a fairly good cock, because it is very easy to spoil a cock. (2) It is better to remove the tap, although it is not impossible to do without this. Remove the plug of the cock, then smear on a little flour emery powder which has been made about as thick as cream with water. Put the plug in again, and twist it round once or twice. Now remove it, and there will be seen bright parts where the emery is rubbed off and dull parts where the emery has scarcely been disturbed. Wipe the plug clean, then smear emery on the bright parts; replace the plug, and work it round for a time. Each time the plug is removed, wipe it and put emery where it shows bright, until the whole of the plug appears to wear evenly. When finally replacing the plug, be sure it is free of emery, and then grease it. It is a rather slow process by hand, and to grind in a cock satisfactorily a lathe gives best results and is much quicker.

Leather for Water Taps.—Valve leathers are usually made of "oil-dressed" cow-hide or similar leather, the pieces or discs being cut or punched out to the required sizes. The best valves are turned in a lathe to thickness, the rough surfaces trued, and the sharp edges taken off.

Repairing Draw-off Taps.—In the case of ordinary household water taps persisting in passing water unless actual force is used to screw them down, if the taps are of a common description, and are used for cold water, they should be taken to pieces and new leather washers (which can be bought of any dealer in plumbers' materials at 2d. or 3d. each) fitted and fixed on to the jumpers. If the taps are used for hot water, then indiarubber washers should be employed instead of leather ones. When the valves are taken to pieces the seatings of the barrels should be examined, and if found to be pock-marked by corrosion, or cut or roughened by grit, etc., they should be made smooth by turning them in a lathe. The screw of the jumper should also be examined with a view to ascertaining whether it is too long and whether it "bottoms" in the barrel. Fairly satisfactory results in the case of ordinary cold-water taps have been obtained by removing the rough burred edge from the

seating by means of a rose countersink. For the leather washer may be substituted one made from good thick sheet rubber, which, though not quite so durable as hard leather, wears for a long time if the tap is turned off gently.

Washerless Water-tap (Lord Kelvin's).—Lord Kelvin's tap is of the screw-down variety, with a valve shutting down on to a seating, much in the same way as in ordinary screw-down taps. The important difference is, that the valve does not cease to move as soon as it presses on the seat, but continues to revolve for a little while in a way that is equivalent to a grinding or facing process which keeps the valve and the seating perpetually true to one another. Both are metal, hence the term washerless, and the tap is also without packing of any kind.

Taps, Engineers' (*see* Hardening and Tempering)

Tar

Tar is obtained by the destructive distillation of wood, coal, peat, shale, etc. Archangel, Stockholm, and American tars are wood tars obtained by burning in a cavity in the earth billets of pine or fir, these being covered with turf and burned slowly without flame. The cavities are in the side of a hill, and the tar runs through a spout into a barrel. English wood tar is a by-product of the manufacture of wood-vinegar (pyroligneous acid) and wood spirit (methyl alcohol) by destructive distillation. Coal-tar is a thick, black viscid liquid, which condenses in the pipes when gas is distilled from coal. It contains a great number of different substances. Its basic oil is the chief source of the two thousand distinct shades of aniline colours so extensively used in the arts.

Cleaning Tar Jar.—The jar can be cleaned with petroleum spirit or benzol and a little sharp sand. Shake this round from time to time, and leave the jar until the material is all dissolved off, then pour out and put in a fresh lot to get the jar perfectly clean.

Coal-Tar Products.—Some of the products of coal-tar are the following:—Of medicines and similar preparations, it furnishes antipyrin, ammonia, antifebrin, asporal, carbolic acid, diuretin, dulein, euphorin, exalgine, hypnol, malarin, naphthalene, phenacetin, phenol, salol, sulphonal, trional, hylene, and many others. Of perfumes, coal-tar yields queen of the meadows, cinnamon, bitter almonds, camphor, wintergreen, and thymol. Bellite and picrite are powerful explosives obtained from it. Of flavouring extracts, it yields those that give a close imitation of the taste of currants, raspberries, pepper, vanilla, etc. Benzine, naphtha, ammoniacal fertilisers, the photographic developers hydroquinone, eikonogen, etc., microscopists' stains for tissues, paraffin, creosote, pitch, a paving material, saccharine, which is a substance three hundred times sweeter than sugar, saccharine-amide, which is still sweeter, lampblack, colouring matter for red ink, lubricating oils, varnish, resin, nearly all the ammonia of commerce, and more than two thousand distinct shades of aniline dyes all are the products of coal-tar.

Hardening Tar. Tar applied to a shed roof may be found to melt and run when the sun is very hot. The difficulty may be overcome by melting at a good heat 7 lb. of coal-tar pitch, and mixing well in a bucket of tar which has been previously warmed. Apply the tar while warm, afterwards sprinkling the work with fine sand. Adding the pitch thickens the tar and causes it to dry much harder.

Stockholm Tar. Stockholm tar is obtained during the manufacture of charcoal from pine wood. It is an excellent preservative for woodwork, and is better than coal-tar. Stockholm tar can be thinned with creosote oil or coal-tar naphtha, or with wood spirit. Swedish pitch may be melted and the tar stirred into it for thickening purposes. It is, perhaps, best to apply the tar hot, because heat expands the cells of the wood, and the subsequent contraction causes the tar to be drawn into the wood. Swedish pitch is simply the tar heated until the liquid volatile portions have distilled over.

Stockholm Tar to Dry Hard.—Melt down 50 lb. of pitch and stir in 50 lb. of the tar; apply the mixture while it is hot. If the tar is to be used cold, allow the mixture to

cool somewhat, and very carefully add coal-tar naphtha or benzoline until the right consistency is gained. The mixing should be done in the open air, as naphtha and benzoline are very inflammable.

Stockholm Tar, Thinning.—Stockholm tar can be thinned by adding turpentine; or, if something cheaper is desired, use paraffin or coal-tar oil. It would be best to warm the tar first, then remove it right away from the fire and stir in the turpentine or other liquid.

Tarpaulins

Tarpaulins are made by coating canvas with a mixture of boiled linseed oil and lampblack, though other materials are sometimes added for cheapening the mixture. Lampblack ground in turpentine is finer ground than the dry lampblack, and will disseminate better through the oil. Lampblack is a bad drier, hence the less used the better. About 6 lb. of the mixture would be required for a sheet 14 ft. by 18 ft. The cloth is often filled by treating it with size, and the paint is laid on the surface either on one or both sides. The paint is made rather thick by grinding the lampblack with the oil in a cone paint mill, and when applied by hand it is spread with a long, broad-bladed knife; machines for spreading are, however, used in manufacturing tarpaulins on a large scale. A mixture of Stockholm tar, tallow, and American pitch will dry well, and forms one of the preparations used for tarpaulins. The railway companies generally use a prepared sheet dressing supplied by oil and colour makers. For a yellow dressing, use boiled linseed oil coloured with yellow ochre; if it does not dry quick enough, add a little patent driers. First give the canvas a good dressing with plain boiled oil; when that is dry, coat both sides with the coloured dressing. The dressing should take several days to dry; if it dries quickly it will be liable to crack.

Tartaric Acid (*see* Acid)

Taxidermy (*see also* Skins)

Cleaning Stuffed Birds.—First remove the glass, and with a pair of bellows and a large camel-hair brush clear away as much dust as possible from the specimens and surroundings. This will probably be all that is necessary; but if the birds have become discoloured by the combined action of mould, grease, and dust, each specimen should be detached from the twig or groundwork upon which it is mounted, and treated separately. The removal is effected by unclamping the wires passing out of the feet. The bird should first be drenched in benzoline; fine sawdust or plaster-of-Paris should then be gently rubbed on in the trend of the feathers until the spirit is removed. It may be necessary to repeat this operation if the specimen is very dirty. The dust is subsequently removed by a vigorous puffing with the bellows, and the feathers rearranged. The birds having been replaced in the case, the surroundings should be restored by the careful application of tube oil-colours to the grasses, etc. The grass is then cleaned and returned to place. Strips of black or mahogany-coloured paper, attached to the edges with Seccotine or glue, will make the case air-tight. Another method of cleaning is as follows: Drench the bird liberally with benzoline, and lay it on a sheet of paper on the bench. Then, with a large pad of cotton-wool, carefully rub in plaster-of-Paris and finally cover the bird with a quantity of the powder, and leave it for an hour or two to absorb the spirit. When ready, remove the bird and shake the plaster out of the feathers as far as possible; then, with a light cane or a length of stout wire, gently beat the specimen—preferably outdoors, as a cloud of dust is produced, and the wind will blow this away. Next wipe down with a clean pad of wool, slightly damped or dry, using, if damp, very clear spirit. Repeat the beating and wiping until all the plaster is removed. Then rearrange the feathers, and retouch the specimen where necessary. A better medium than plaster-of-Paris is good white starch, thoroughly powdered. This imparts a slight gloss to the plumage, whereas the plaster destroys the gloss. Either can be used several times, until it becomes dirty.

Curing Birds' Tails.—First remove the pygostyle or "parson's nose," together

with the attached feathers, from the skin itself, and, holding the quill shafts at their bases between the finger and thumb of the left hand, with the right hand pass a medium-size wire, pointed at one end, transversely through each shaft, taking care that they are threaded in their natural order as in life. Now draw the projecting pointed end a little way, and give it a sharp turn some little distance away from the outside quill. Then twist this looped end together until the spiral comes in contact with the feather, carry the free end across the shafts, and repeat the operation on the other side. This process of wiring should now be carried out a second time a little higher up the stem of the quills, and it will thus appear that the flesh and bony portion may be entirely dispensed with by cutting the feathers across close to their bases. The wires and the bases of the quills should subsequently be covered with black paper glued on, and the tail will then be ready for its millinery purpose.

Disguising Odour of Albatross Skin.—It is impossible entirely to eliminate the smell, which emanates from the oil with which the feathers are impregnated, but it can be disguised to a great extent. The best medium perhaps for the purpose, if the smell is not objected to, is carbolic acid. Dissolve 10 gr. of absolute phenol (pure acid) in 5 oz. of rectified spirit or pure methylic alcohol, and spray the feathers all over with an ordinary scent-spray. Or a few drops of oil of citronella, birch, or lavender sprinkled on to the skin itself may answer, although the first method is the more satisfactory.

Fixing Artificial Eyes in Mounted Birds.—When mounting small or medium-size birds, cotton-wool should be placed in the orbital cavities, a small portion being drawn out through the eye ring with the tweezers, when the head has been returned into place, the eye ring itself being worked into the required position by means of a needle. For large birds a little modelling clay should be placed over the cotton-wool, and a small cavity, to contain the eye, formed from the outside. When the bird has dried, and it is desirable to insert the eyes, two pellets of cotton-wool saturated with warm water should be placed in the eye cavities, and re-damped from time to time until the skin is perfectly relaxed. In fixing the eyes in small birds, more cotton-wool should be inserted into the eye cavity by means of tweezers, and a little Seccotine smeared on the interior of the eyelids. Then, grasping the bird by the beak with the finger and thumb of the left hand, grip the eye in a pair of broad-nose tweezers with the right hand, and, resting the little finger on the top of the bird's head for support, insert the eye. Subsequent careful manipulation with the needle will perfect this operation, which is generally somewhat troublesome. In larger birds, where clay has been added, there is no necessity for Seccotine, but the method of insertion is similar.

Fox's Brush Mounted as Bell-pull.—Get a piece of copper wire the same length as the brush and make a loop in the end to attach to the bell rope. Wrap the wire with tow of the same thickness and taper as the original tail, then insert it into the brush till the root of the tail is up to the loop; bind the skin close to the loop with fine copper wire, and over this fix a ferrule. Be sure to allow the brush to get set before attaching it to the bell rope.

Fox's Brush Mounted on Handle.—If the brush is required stiff, get a piece of steel wire about 1 in. longer than the brush, wrap it with tow, then insert it into the brush. The handle should be about 6 in. long with a shank turned on the end about 1 in. long, so tapered as to enter the root of the brush. File a point on the wire and bore a hole a trifle smaller than the wire in the shank of the handle, then drive the wire into the handle and neatly tack the skin round the shank. If the brush is required soft, put the shank into the brush and tack neatly to it.

Groundwork in Taxidermy.—With regard to the fitting up of cases to receive mounted specimens, the amateur will obtain best results in making up ground and rockwork if he uses peat. The turf itself, which is dug out of the moss beds in parts of Lancashire, the adjacent counties, and Ire-

land, in the form of square flat pieces for use, when dried as fuel can be obtained in suitable condition for taxidermic purposes from nearly all dealers in natural history requisites. The most suitable is taken from the upper strata, and is softer and more spongy than the darker and lower peat. In its use for making groundwork it may be well to describe as an example a group of a family of stoats feeding on the remains of some young thrushes. The idea adopted was a clean section taken out of a bank in a wood, showing the holes of these animals. A fallen log of rolling wood occupied a central position on the upper portion of the bank, partially overhanging a sharp declivity. From this the ground sloped gently upward behind, but below the earth crumbled away, and roots of shrubs, etc., were represented hanging out here and there. The base of the group was constructed of deal planking 1 in. thick, about 2 ft. 6 in. long, and 2 ft. wide; it was clamped at each end to prevent possible warping. On this the bough was first fixed in position on a framework, lightly constructed of oddments of planks, and raised about 6 in. off the ground. This structure was continued above, sloping upwards slightly, upright stays occupying the corners of the stand. The turf was then cut into flat pieces about 2 in. thick by dividing the original squares with a handsaw, and these plates were then nailed in position on the stays with wire nails, a fit between the adjoining pieces being secured by cutting the edges of each with a sharp knife. When the upper cross-stays have been completely covered in this way, the front aspects of the bank, the shelving portion and lower ground itself, were formed in the same way. Then came the after modelling, the putting in of detail and the cutting of the holes, all of which were carried out with the knife. Three holes were made in the present case, one situated under the bank partly hidden by the end of the bough, another above burrowed right under the side of the log, and the third in the upper portion of the bank under a tuft of grass. Up to this point, the back and sides of the bank showing the section had not been attended to. A strip of paper was now taken, of sufficient length to pass right round the two sides and back, and this, cut roughly into the contour of the section, was first soaked in water, then glued all over, and pressed carefully on to the edges of the ground board and top of the groundwork. Quantities of cotton-wool were next forced between all the uneven joints and into unnatural hollows, etc.; cotton selvedge or skin was then spread over this, and dabbed down well with a stiff brush and strong size and whiting in equal parts, boiled together with enough water to the consistency of thin cream. By this means, all the cracks between the turf plates and unnatural surface were removed, and the contour of the groundwork began to assume a natural appearance. When it was dry, two applications of thin glue all over were laid on freely, and were followed in each case by fine sand dusted on with some force, a few hours elapsing between the coats. About a week was allowed for complete drying, during which time natural grasses, dead leaves, broken twigs, moss and lichen were procured. The first of these were carefully ironed out in tufts and retinted by means of oil colours, namely, chrome green Nos. 1 and 2, with a medium composed of one-third of mastic varnish and the remainder turpentine. The leaves, mosses, lichens, etc., were simply dried to await subsequent treatment. In colouring the groundwork, ordinary mixed paint was used at first, yellow ochre principally, to represent a clay soil, thinned down simply with turpentine. The mosses and lichens were then glued neatly on the dead branch, pins being necessary temporarily to hold them in position. These were also required with glue to fix the tufts of grass, but as the group was destined to be cased up at once, the dead leaves, twigs, etc., were left out until the last. The specimens were then placed in position. An adult male was posed at the end of the log, crouching down to watch the female, whilst two half-grown youngsters were represented disputing the possession of a leg of one of the hapless nestlings, a third meanwhile just emerging from the hole under the trunk. Before the casing up, finishing touches

were added with the brush and tube colours to the groundwork, streaks of black, dull brown, green, etc., while a little green was lightly stippled with a dry brush on parts of the tree, and the mosses and lichens received a little judicious tinting.

Groundwork: Further Practical Hints.—The following deals with the methods of producing special variations suitable for smaller cases. In the making of any specimen of a certain kind of rock, for introduction into taxidermic grouping, a copy should always be selected, and counterfeited as nearly as possible in all its details. In the case of sandstone showing strata, peat blocks should be employed, the rough modelling being carried out systematically; the strata should appear at the ends and reappear throughout in broken but persistent lines. On a slanting surface, the edges of the strata, being of harder stone, should stand out in ledges. This can partly be accomplished with the peat itself, and finished with an upper layer of cotton-wool well glued down. The backing of the cotton-wool, being porous, will give the appearance of minute pitt ng, which is heightened by the careful application of pulverised natural rock. The interstices between the projecting ledges have a crumbling appearance, and this can be counterfeited by the use of coarse cork sawdust, glued on, and covered with more powdered rock. Variety of colour can be gained by using different-coloured rock powders; but a little darkening here and there, before applying the final thin coat of varnish, by means of tube oil colours—raw umber, greys, and black—will be necessary to relieve extreme flatness. Chalk may be represented by crumpling up a thin cardboard box to a suitable shape, and nailing it in position. This is then covered with pieces of soaked paper well glued on to the flat surfaces, and stretched across unnatural gaps. More or less sharp edges should be aimed at, if the rock is represented above high-water mark; but otherwise a more general smoothing should be carried out by means of cotton-wool at the angular points. Rockwork of this description should receive a coat of thin size, followed by a careful application of superfine plaster-of-Paris. Subsequent tinting should be in thin coats—light green and grey—with a plentiful thinning of turpentine and varnish in equal parts, in order to dull the whiteness of the plaster without losing anything of the natural surface. Shore rocks partially embedded in the sand are generally covered with green weed. This may be admirably counterfeited with strands of tow tinted to the various shades by dyeing in spirit aniline green. As the dye is absorbed by consecutive immersion of tow in bunches, various natural shades will be produced. The resultant material should be allowed to dry before use. In attachment to the rockwork, it should be well covered with thin size; this not only gives it a streaky appearance, but tends also to fix the otherwise unstable character of the dye. In such cases, moreover, a lavish application of varnish will be necessary, to impart an appearance of moisture. Other varieties of sea rock may be made in a similar manner, the surface being either covered with sand or plaster, or glass-papered quite smooth and subsequently coloured. In this last operation, upon which depends the natural effect or otherwise of the work, the general rule to be followed is to darken hollows and lighten projections. Sharp ledges should be rubbed with glasspaper, and scratches, such as are made by birds' claws, added here and there. Lichens and mosses on land rocks should be very carefully attached by means of fish glue, and secured by means of pins until dry. Droppings of birds, in cases of nesting places, etc., may be represented by splashes of whiting and thin size. Other accessories to a show-case, such as pebbles, fragments of shells, and seaweed, should be selected well in keeping with the nature of the rockwork, and such objects as starfish and crabs included only in rare instances.

Groundwork for Group of Chamois.—There will now be described the manufacture of artificial rockwork on a large scale, where broad effect principally is aimed at, taking for an example the fitting up of a group of chamois—two males, a female, and two young, collected in the Valaisannes Alps. The case itself was about 6 ft. long by 4 ft. wide by 5 ft. high, having

plate-glass sides and top. The rock represented was of the blue liassic variety found in certain regions of the Swiss Alps. Viewing the group from the principal show side, a plateau is raised for about $3\frac{1}{2}$ ft. on the left, sloping gradually downwards for about two-thirds of its length; it then takes a sudden upward curve to form the summit of a broken crag 4 ft. high on the extreme right of the case. The whole of this portion occupies a little more than half the width of the floor, on the further side. The broad side descends with an inward cant to the ground, interrupted here and there by a crevice or protuberance. On the near side, below the upper rock, a platform raised about 1 ft. 6 in. from the ground joins the base. This platform starts in its full width, about 1 ft. 8 in., 2 ft. away from the right end of the case, and runs along more or less unevenly until about 3 in. from the glass at the other end; then, with a rough, semicircular sweep, it meets the farther corner of the base of the upper rock, so encircling it with a rapidly decreasing ledge, about 6 in. wide at its broadest point. A rough framework of wood was first constructed, shaped as near to the contour of the rock as possible. Some 3-in. battens were fixed, upright, to the floor by means of four supports, to form the corners of the ends of the upper and lower plateaux; to these were nailed strips of planking passing to the principal points. Across these in turn were nailed other pieces, until no greater distance than 6 in. existed anywhere between the strips. The tops of the plateaux in those parts where the specimens were finally placed were of course constructed more substantially. On these cross-pieces were secured irregular pieces of turf, broken card-boxes, and other suitable material, to form the natural ruggedness of surface. When this had been carried out, a quantity of fine canvas was procured. This material, although most suitable, is not indispensable, as cheese cloth or unbleached calico will answer the purpose equally well. The canvas was cut into lengths, and tacked entirely over the whole structure, being secured to the hollows by means of tacks run through small pieces of card. Here and there, the outline was improved by pushing crumpled newspaper, etc., underneath. The canvas was next entirely covered with newspaper, which, torn into strips about 6 in. by 4 in., was moistened and pasted on by means of thin size melted down with a small addition of plaster-of-Paris, a nail-brush being used to beat it well in. A second covering of paper was then applied to obviate the appearance of cracks through warping. To allow of thorough drying, it was left for a fortnight before being coloured. In the meantime, some fine rock grass, yellow lichens, and other vegetation were procured from the regions inhabited by the chamois. The grass was dried in tufts and afterwards retinted with tube oil colours—chrome green Nos. 1 and 2, and chrome yellow. The lichens were merely dried, and required no after treatment; but the other plants, amongst which were some growing specimens of rock cystus, gentian, violæ, etc., were modelled. As the modelling process is not generally understood, however, it may be mentioned that fair results are often obtained by plunging such vegetation while still fresh into hot paraffin wax, and restoring the colours afterwards. The surface of the rock was well rubbed down with glass-paper, which removed all traces of the overlapping paper, and then given a general coat of colour. The colour, which was at first laid on with a large brush, was composed of a mixture of "dry" lampblack, zinc oxide, and blue, the medium employed being a mixture of equal parts of common varnish and turpentine. When the first coat had dried, detail was carefully put in, the hollows were darkened, an irregular streak of black laid on here and there, and a suspicion of light green and yellow stippled on with a dry brush. Some of the sharper angles were then rubbed with glasspaper, which imparted a natural, warm appearance. A little loose earth having been thrown on here and there in the crevices and hollows, the vegetation was "planted," and secured with glue and fine nails, the latter being afterwards withdrawn; the lichens also were carefully attached. The specimens were then posed to suit their respective positions, and grouped accord-

ingly. One male was represented with his four feet almost together, as if he had just alighted on the extreme top of the crag; whilst the second was placed with his head lowered, as if about to give battle to this disturber of his quiet retreat, advancing down the opposite slope. The female stood on the lower plateau, with her shaggy little offspring at her side, prepared to defend them, should her lord's attack prove futile. Such a group as this forms a strikingly handsome centrepiece in the trophy-bedecked hall of a sportsman.

Head, Modelling.—The following is the method of mounting a skin with a raised head when there is no skull. A model of a head should be carved out of peat, cork, or any other suitable material; this can be subsequently covered with a layer of modelling clay, which will allow of superficial formation of the eyelids and lips. In the case of a large skull, where an open mouth is desired, the teeth, palate, and tongue should be modelled by hand out of gilders' composition, made as follows: Boil 7 lb. of glue in 3½ pt. of water, and melt 3 lb. of resin in 3 pt. of raw linseed oil. When both are ready, pour together and simmer for half an hour, stirring well. Finally pour the resultant liquid into a sufficient quantity of finely powdered and sifted whiting, and knead together until a stiff paste is formed. The surplus material should be rolled into cakes of convenient size, and subsequently softened for use by steaming over a water bath in a muslin bag. The interior of the mouth thus modelled is afterwards tinted by means of tube oil colours, with a medium of good varnish and turpentine. The palate, tongue, and gums of a fox's head, mounted with mouth open, may be reproduced in gilders' composition, obtainable at any picture-frame maker's. This should be applied, when softened by heat in a water bath, by means of a suitable modelling tool, superficial detail being carried out with moistened finger-tips. The tongue may also be modelled, on a suitable base of wood or tow saturated with glue, with the same material. The whole interior of the mouth should then be tinted by means of tube oil colours—vermilion, orange, and white in combination, or burnt sienna, scarlet lake, yellow ochre, and white, will produce an excellent flesh colour. The medium used should be mastic varnish with a little turpentine. When the original tongue is present, and is in good condition, it may be skinned out, and remodelled over pipeclay. The combs and wattles of fowls should be allowed to dry in natural positions, and can then be superficially restored either with hot paraffin and japan wax in equal parts, tinted with oil colours, or with the above medium liquefied to the consistency of cream with water, either composition being applied with a suitable brush and hot modelling tool; the fingers are then used to produce a natural surface.

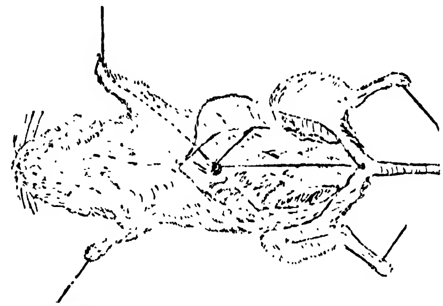


Fig. 552.—Body of Small Mammal Wired for Mounting.

Mounting Small Mammals.—The following is a quick method of dealing with mice, shrews, and other small animals. Having skinned the specimens (*see* p. 500), make up the flesh removed from the skull with soft modelling clay, insert the eyes, and fill the cranium with cut tow. Then, selecting one body and one tail wire, and four leg wires of sufficient length, point them separately with a file at one end. Drawing out the leg bones from within to their fullest extent, pass the pointed end of each wire through the pad, and then wrap cotton-wool round the wire and bone to the natural contour and proportions of the flesh removed. Round the tail wire twist a fine strand of the same material to the natural size, and insert it carefully. Pass the last wire through the skull, and then, gathering the six wires together, twist

their ends up firmly (*see* Fig. 552). Draw down the limbs slightly on the wires and extend the head and tail to their fullest extent. Next proceed to pack the skin with fine sawdust, using a small stick to thrust it well into place. On reaching the opening cut, place a thin layer of cotton-wool over the stuffing, continuing to pack in further sawdust wherever necessary, and then sew up. Pose the specimen by arching the back and bending the legs into their natural positions, and finish by modelling the head into shape. This style of setting up requires some practice to be successful, but is very rapid, it being possible to mount a mouse in less than half an hour. In the case of moles it is unnecessary to make up the limbs at all, but the wires in the fore-legs should be inserted through the sides of the hands, as these members are always carried sidewise. Bats, which are generally a stumbling-block to most taxidermists, may be mounted by this method. The wires should be passed down the bones in the fore-limbs from the wrist. The best plan of drying such animals after mounting is to lay them out on a board, and then to extend the wings to their fullest extent; next, having placed a small quantity of cotton-wool under each, secure them in position with a few entomological pins passed through the front margin of the membrane, the specimen being further secured with two pins passing through the feet.

Moth Preventative. — Use naphthalene (albo-carbon) either alone or mixed with an equal quantity of camphor and white pepper.

Preserving Fowl Skins for Making Fishing Flies.—Roughly strip the skin from the body; making a central cut down the entire length of the neck and body, draw out the wing bones and legs, and remove them together with the flesh and scaled part of the legs. Cut away the skull at the beak, and, opening the upper portion of the wing with an incision down its length, remove as much flesh as possible. Then, with a blunt knife, scrape away all the fat and oil glands from the interior of the skin, and, laying it out flat on a table, paint it over with the following preservative: whiting 1½ lb., soft soap ½ lb., chloride of lime ½ oz., and eucalyptus oil ½ oz. Boil together the whiting and soap until amalgamated, with 1 pt. of water; then add the chloride of lime, and finally the eucalyptus oil when cold. In a few days the skins will be dry and stiff, and can be packed away, one above the other, with a sheet of tissue paper between. A little naphthalene will prevent moth.

Preserving Small Reptiles.—Get a bottle large enough for the purpose, make two incisions in the abdomen of the reptile, place the reptile in the bottle, and fill up with a mixture of 2 parts (by measure) of 95 per cent. alcohol and 1 part of water. Close the bottle with a tight-fitting cork or stopper.

Preserving Starfish.—Starfish are preserved by placing them in several changes of fresh water to remove the salt, and then keeping them in spirit of wine. Or the fish might be kept in a saturated solution of common salt, which is a very different material from sea-water. A useful solution for the purpose of preserving soft animals is produced by dissolving 4 parts of common salt and 1 part of alum in the least possible quantity of water.

Skinning Small Mammals.—The value of specimens from abroad depends to a great extent upon the care taken in their preparation. In skinning, remove the trunk, the head, and the flesh adhering to the limbs. Then rub the inside of the skin well with fine sawdust to remove all superfluous fat, etc., and follow this with an application of powdered arsenic. Wrap the leg bones with cotton-wool and return them to place; then, taking a sufficient quantity of the same material, roll it between the hands into a close cone, and insert it in the skin. Select a fine wire long enough to extend from the tip of the tail to the upper end of the opening cut, and having wrapped one end with wool to form an artificial tail, insert it in the skin. Having sewn up the cut, lay the specimen on a board (*see* Fig. 553), and draw the fore-legs upwards on a level with the head, securing them through the hand with fine pins. Then lay the hind-legs, soles downwards, alongside the tail, and fix them in the same manner. The finished skin should now be put away to dry, with a label noting particulars as to

sex, measurements, locality, and date. The skull should also have a tally attached bearing a number corresponding with that on the specimen.

Snake Skins, Curing and Stuffing.—In the preliminary curing of sun-dried snake skins, the best plan will be to immerse the skins in warm water for about two hours; this will soften them sufficiently to allow of unrolling, which should be done carefully and without using unnecessary force. Any loose patches of scales should be collected and marked A, B, and C, to correspond with their place on the skin, this being defined on a rough sketch. In cases where the skin has been opened up for a short distance, draw apart the flaps to allow of the easier admission of the water. When the skin has been thus partially softened, ing snakes of small or moderate size. First hang the skin up by the head, at a convenient distance from the ground. Then cut a suitable wire a little longer than the snake, and, having sharpened one end, lightly bind on sufficient tow to cover it. Insert this down the interior. Next procure a quantity of fine sawdust, and, by means of a tin funnel, pack it into the skin. By grasping the skin between the finger and thumb and drawing the hand gently downwards while shaking the tail vigorously, the dust will gradually settle down. When the sawdust is within a moderate distance of the upper cut, a stuffing-rod, with the end bound in tow, may be used for pressing down. The upper cut should be sewn up in sections with a neat skin stitch as the packing-in

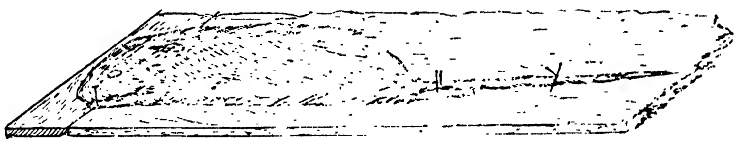


Fig. 553.—Skin of Small Mammal Pinned to Board.

pare away any adhering fat that can be reached; then place it for about half an hour in a curing bath composed of ½ lb. of salt, 1 oz. of best sulphuric acid, and 3 qt. of warm water. Remove the skin occasionally to pass a blunt-ended stick down the interior, to assist the penetration of the fluid. This will generally suffice to soften specimens of moderate or small size, to allow of subsequent mounting; but in the case of larger specimens, a longer period of soaking may be necessary. Moreover, it may be imperative to open up the skin to its entire length on its lower surface, if this has not already been done, with a pair of sharp scissors. This will allow of thorough currying, which will render the subject more supple, but should not be resorted to unless it is found impossible to permeate the skin otherwise. The immersion in this liquid will suffice to destroy any living larvæ still infesting the specimens. The following is a very satisfactory method of stuffing and mounting snakes of small or moderate size. First

proceeds. On arriving at a point about 6 in. from the head, the body wire should be attached to the skull. Having closely filled the brain cavity with chopped tow, insert the point of the wire into the spinal cord outlet, and, piercing the bone at the base of the skull, draw it out with the pliers, bend it back, and secure it firmly by twisting it round the body core directly behind. Then finish packing the trunk, and, placing a pad of tow in the neck, complete the sewing up. The next operation is to pose the specimen roughly, either on a branch or on a suitable piece of plank. Fine wire nails, driven carefully through the specimen itself at necessary points, may be used for this purpose. The eye cavities should now be filled with modelling clay, and the eye itself carefully fixed in position. The specimen is then left to dry pending further treatment. This will consist of the reattachment of loose patches of scales by means of fish-glue, the modelling up of the head from without, and the

necessary retinting of the lost colour. The scales should be restored very carefully, fine tweezers being used for the purpose, and only a moderate quantity of the adhesive. A mixture of equal quantities of paraffin and japan wax, heated together over a small spirit-lamp and tinted to the correct shade by means of tube oil colours, should be employed for the modelling; it should be applied in a half-cooled condition by means of a suitable modelling tool. For reviving lost colour, which is an operation requiring some artistic ability, tube oil colours are best, the medium being pure turpentine, with a sufficient admixture of heavy varnish to eliminate the "flatness."

Snake Skins Mounted for Wall Decoration.—Assume that it is desired to mount the skins of eight snakes from 2 ft. to 4 ft. long, for hanging upon walls, in two lots of five and three; the skins are cured, and laid out flat. A very striking wall decoration might be effected by mounting them coiled round each other as if fighting; but this would be a difficult piece of work even for an experienced taxidermist. The skins should first be soaked for a few days in water with an addition of a fair quantity of bran. On removal, the flat skins should be carefully sewn up, and the hollow filled with damp sand, a piece of putty being placed in the head. The specimen should then be posed in position on a piece of board, and secured by means of a few nails, then left to dry. The other specimens, after being similarly treated, should be fixed as desired on the same mount. When dry, the trophy should be mounted on a polished shield, secured thereto with fine nails driven through at necessary points, the skins being given a thin coat of fine varnish. A simpler but less effective method of display would be to mount the flat skins on red or green baize, with the heads of the five specimens meeting in the form of a star, and those of the three specimens in the form of a broad arrow. In this style the skins need only be sewn to the backing, the edges of the thick baize being scalloped close to the edges of the skins. A loop attached to each apex of the trophy—that is, the tails of the skins—will serve to keep the trophy in position on the wall, when each is slipped over a nail driven at the required position. The above directions would also be applicable, with slight modification, to lizard skins.

Swan Mounted in Swimming Position.—The glass used to represent the water should be of the thick, waved kind, of a pale green or brown tint. An oblong aperture should be cut out of it in the required position, large enough to receive half of the swan's body. This operation should be done by an experienced glass-cutter. The contour of the body should be taken by means of a strip of pliable metal, from which the size and shape of the required aperture may be drawn on paper, this being subsequently attached to the flat surface of the glass. A less satisfactory but easier method is to cut the bird neatly in half, the metal band being employed to obtain a straight cut, and then to attach the two halves one on each side of the glass, which should in this case be as thin as possible. In this method four small holes should first be drilled through the glass by means of a steel brooch drill running one way, and constantly sharpened on an oilstone. Four lengths of wire are then passed through the holes to the stuffing and skin of each half of the bird, and when the two sections have been brought into position the ends should be twisted into hooks and hidden amongst the feathers. A careful arrangement of the feathers on the surface of the water should be observed. In casing up the exhibit the edges and depth of the water should be disguised with a band of black paper.

Water in Taxidermic Work.—Deep water is generally represented by thick waved glass of a brownish or green hue, the edges being carefully embedded in the surrounding peat-groundwork. Shallow water is counterfeited by thin crown glass, entirely varnished in a streaky manner on the lower side. The stones, etc., below the surface should also receive a sparing coat of varnish, not sufficient to render them shiny, but enough to modify their dry appearance. The margins of the pool or stream should also be well varnished, care being taken to prevent the upper surface of the glass

from being touched. Suitable glass of various shades, either suggestive of shallow or deep water, is specially manufactured in Germany for the use of taxidermists. This glass is unevenly rippled, and has slight variation of colour; but the ordinary waved glass, as used for fanlights, etc., and obtainable at any glass warehouse, is often used to represent deep water suitable for a case of seagulls; whilst ordinary window glass, preferably that of the worst quality obtainable, on account of its slight irregularity of surface, backed below with a thick coating of glass varnish and a dull yellowish-green tint of colour, may be used to represent still water.

Telescope

Cleaning Telescope Lenses.—One thing to be careful about in cleaning a telescope is to see that the lenses when returned to their fittings occupy as nearly as possible their former positions. It would perhaps be wise to clean each lens separately, carefully marking with a lead pencil the edges of the lenses in the objective and the cell, so that when the lenses are returned the lines are guides. The eye-piece lenses being burnished into their cells present no difficulty. To clean the lenses, first sponge the surfaces with cotton-wool dipped in spirit of wine, then polish with a fine cambric pocket handkerchief.

Tempering (*see* Hardening and Tempering)

Tennis

Tennis Balls, Whitening.—Blanco is said to have many advantages over pipeclay. It not only whitens the balls, but the dirt does not so readily adhere to the balls after the Blanco has been applied. Ordinary whitewash made thin would be suitable for whitening tennis balls, but the whitewash would soon get knocked off again, because of its brittleness. A better plan would be to dip the balls in a thin boiled starch solution, then in dry white French chalk; next rub the balls round with the hands to make them smooth, and allow to dry.

Tennis Racquet, Restringing.—Gut for restringing tennis bats must not be wetted or even damped with hot or cold water to make it pliable, or it will be spoiled. To restring a racquet, cut out the old gut, pick out all pieces from the holes and grooves, and well wipe round the frame with a French chalk rag. Get a couple of awls in handles, and push one through the holes to clear them. Gut may be bought in 18-ft. lengths, and a full-size tennis bat takes two such hanks. Hook a hank on a ring, and, holding it in the hand firmly, undo it gently without knots. Put the centre on the hook or handle, get hold of each end, and walk backwards, stretching the gut; then if no knots or kinks are in, pull it tight; this makes it pliable. Count the holes round the racquet and find the centre two at the top. Start in these so as to work half of the

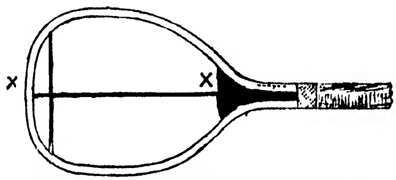


Fig. 554. Restringing Tennis Racquet.

Fig. 555. Tool used in Restringing Tennis Racquet.

racquet at a time, and thread through and through till the two ends come off to a finish. Lift the loop outside the racquet and put the ends through. After the main gut is in and the ends under several of the loops are down, the racquet must be tightened up. To do this is a very difficult job, because if a support is not put in the bat (*see* Fig. 554), pulling on the gut string to bring the slack through will pull down the top of the bat. To prevent this a tool in two pieces (Fig. 555) is used, one piece fitting in the other. The plug when in place butts against a thumb-screw, by which it is adjusted to any length. When this support is put in, the cross string can be started in the top side at a V- or W-shaped groove. Trace over and under each main string, but see that the right hole is worked when the gut comes out on the

other side, so as to drop in the channel or groove that is made to receive it. Pull on each string and wedge it by a smooth pointed awl in the hole where the gut is being held. Two awls are wanted, so as to keep one string tight while pulling on the other. When the cross strings are nearly done the support X X (Figs. 554 and 555) should fall out, proving that the racquet is of about the same shape as it was before being worked.

Whiting for Marking Tennis Lawns.—Well beat up the whiting with 3 per cent. boiled linseed oil and 5 per cent turpentine. An excellent way to prepare whitewash is as follows: Put ½ bushel of lime into a clean, watertight barrel. Pour boiling water on to it, covering it 5 in. deep. Stir till the lime is thoroughly slacked. Then add 2 lb. of sulphate of zinc dissolved in water, and 1 lb. of salt.

Terra-cotta

Cleaning Terra-cotta.—Make a strong solution of American potash; mix it into a paste with clean sawdust, and in this cover up the figures for a night. Then wash them with cold water. To clean a large terracotta monument from a mass of colouring of old standing, first roughly scrape off moss with a bone scraper. Water, some sharp but not coarse sand, and a large, stiff paint brush worked with a circular motion will fetch off what remains and clean out the hollows. For other dirt and colouring, use American potash, of which make a strong lye. If possible, lay the monument on its back and cover it with sawdust saturated with the lye. Leave it twelve hours and then wash. If the monument cannot be laid down, mix whiting with the lye, dab it over the surface, and wash off when dry. Repeat, if necessary. Obdurate stains can generally be removed with a poultice of mashed raw potato or with chloride of lime. This last should be used with caution. To remove iron stains, salts of lemon may be necessary.

Theatrical Paints (*see* Grease Paints)

Thermit

Thermit (invented by Dr. Hans Goldschmidt, and patented in 1896 and 1899) is a mixture of finely pulverised aluminium and an oxide, as of iron. When this mixture is ignited by means of a small portion of magnesium, which, in turn, is ignited by a match, a tremendous chemical action is set up, the oxygen leaving the iron and uniting with the aluminium with an accompanying temperature that is about equal to that of the electric arc light. Thermit is composed of 3 parts powdered aluminium and 1 part oxide of iron, and as aluminium weighs about one-third as much as metallic iron, it will readily be seen that the materials must be taken by measure. The two ingredients must be very intimately mixed together. The mixture is usually lighted by a little magnesium tape such as is used by photographers for flashlight work. The aluminium powder is expensive, but the iron oxide is very cheap. In using this process, which makes possible many useful repairs, the mixture is applied through a funnel with a small opening at the bottom, which is covered by a plate of iron. The funnel is placed just over the article to be repaired or jointed. The mixture is placed in the funnel, and when all is ready, it is ignited. The intense heat caused by the chemical combination causes the iron to become white hot, and on removing the stopper, the white-hot molten iron runs into or round the work being treated. Of course, anyone wishing to experiment with thermit would do well to obtain the patented and already prepared material. Otherwise there would be every risk of non-success. In welding steel tubing with thermit, the clean-cut and squared ends of the pipes are brought together firmly by clamps, and the part is enclosed in a sheet-iron casing, jacketed externally with moist sand, the latter being kept in place by a box. The thermit is prepared in a crucible and poured immediately into the mould. As soon as the welding temperature is reached, the screws are tightened one turn to obtain the necessary pressure for welding. The welding temperature is reached 1½ min. after the melt is poured in, and, when cool, the tubing is removed and the collar of newly formed metal and slag surrounding the joint is knocked off by a hammer, a beautifully clean joint being left. It is stated that a 3-in.

pipe, 0·16 in. in thickness, can be welded with 5 lb. of thermite, and that the chemical reaction of this material when ignited produces a temperature of about 3,000° C. (5,472° F.).

Thermometer

Filling Thermometer Tube.—The following is the method adopted for excluding the air, filling with the mercury, and sealing the end of a thermometer tube. The common mercurial thermometer consists of a glass tube of uniform bore, terminating in a hollow bulb. By holding the bulb over the flame of a spirit lamp, a considerable portion of the air is expelled from the bulb and tube; and, the open end of the tube being immersed in a cup of mercury, as the air within the tube and bulb condenses, the external atmospheric pressure drives a portion of mercury in to fill the space. A paper funnel is next tied round the open end of the tube and filled with mercury. Then the mercury already in the bulb is boiled over a spirit lamp, with the result that the whole of the air remaining in the tube is soon expelled and its place taken by mercurial vapour. The instrument being again allowed to cool, the mercurial vapour is presently condensed, and its place supplied by mercury driven down the funnel. The process is continued till both bulb and tube are completely filled with mercury. Lastly, when the mercury has cooled down nearly to the highest temperature intended to be measured by the instrument, the end of the tube, hitherto open, must be perfectly sealed by means of the blowpipe. As the mercury afterwards continues to cool, it will be considerably condensed, and, sinking down, will leave a vacuum in the upper part of the tube.

Graduating Thermometer.—The thermometer has now to be graduated. For this purpose it must first be immersed in melting snow. When the mercury has sunk as low as it will go, a graduation must be marked opposite the extremity of the mercurial column for the freezing point. The thermometer is next immersed in the vapour of water, boiling under a given atmospheric pressure. When the mercury is again stationary, another graduation must be marked opposite the extremity of the mercurial column for the boiling point. The distance between these two graduations is then divided into a number of equal parts, and divisions of the same extent are marked in both directions to the extremities of the tube. The instrument will then be completely graduated, and may be mounted as desired.

Loss of Colour in Alcohol Thermometers.—The loss of colour in alcohol thermometers is not always due to fading, but may be caused by the colour settling to the bottom of the bulb. To stir it up well, the thermometer should be alternately plunged in an ice bath and in water heated to near the capacity of the thermometer, or to boiling point if the thermometer registers more than 212° F. or 100° C. This will cause the alcohol to flow rapidly up and down in the tube, and, of course, stir up the sediment in the bulb and colour the alcohol again, thus making it easily visible against the scale.

Separated Mercury.—To remedy a thermometer in which the mercury has separated, one method is to put the instrument in a long stocking, the bulb being towards the toe, and then, gripping the stocking tightly at the top, to whirl it round rapidly. The centrifugal action will drive the mercury to the bulb.

Thermometer Degrees.—In the Fahrenheit (F.) thermometer, the freezing point of water (actually the temperature of melting ice) is indicated by the number 32, and the boiling point by 212; in the Centigrade (C.) thermometer these respective temperatures are indicated by 0 and 100, and in the Réaumur (R.) thermometer, by 0 and 80. The Fahrenheit thermometer owes its system of numeration to G. D. Fahrenheit, a German physicist living in Holland early in the eighteenth century, and elected a Fellow of the Royal Society of London in 1724; it is used principally in Great Britain and Holland. The Centigrade thermometer, invented in 1742 by Anders Celsius, a Swede, is the standard instrument for scientific investigations; whilst the Réaumur thermometer, which is the invention of a Frenchman of that name contemporary with

Celsius, is used in Germany and Russia, but is being superseded. On the Continent, the Centigrade instrument, which is in popular use there, is known as the Celsius thermometer. To convert F. degrees to C., subtract 32 and multiply by $\frac{5}{9}$; for example, 77° F. = $\frac{(77 - 32) \times 5}{9}$ = 25° C. To convert F. degrees to R., subtract 32 and multiply by $\frac{4}{9}$; for example, 77° F. = $\frac{(77 - 32) \times 4}{9}$ = 20° R. To convert C. degrees to F., multiply by $\frac{9}{5}$ and add 32; for example, 25° C. = $\left(\frac{25 \times 9}{5} + 32\right)$ = 77° F. To convert C. degrees to R., multiply by $\frac{4}{5}$; for example, 25° C. = $\frac{25 \times 4}{5}$ = 20° R. To convert R. degrees to F., multiply by $\frac{9}{4}$ and add 32; for example, 20° R. = $\left(\frac{20 \times 9}{4} + 32\right)$ = 77° F. To convert R. degrees to C., multiply by $\frac{5}{4}$; for example, 20° R. = $\frac{20 \times 5}{4}$ = 25° C.

Thermometer Scales.—The following particulars relate to methods for treating scales which are used in the trade. For boxwood, take one part either of lamp-black or powdered charcoal and one part of tallow; melt the tallow over a slow heat and well mix. To use, rub it well into the divisions and figures, and with rag rub off all waste black. For an ivory scale, to black-in use soft heel-ball, and then rub off vigorously with a rag till clean, and polish with whiting. For a metal scale, first pumice off lacquer, etc., and then heat the scale over gas, using common bottle wax for blacking-in. Clear off all unnecessary wax with a smooth scraper, and pumice off what is left, finishing with fine emery paper and lacquer. To resilver a brass scale, in a porcelain dish put one part of nitrate of silver (crystals) dissolved in fifteen to twenty parts of water; then throw in two or three tablespoonsful of common salt, and let stand for about two hours. Strain off the water, and mix with three parts of salt and two parts cream of tartar. To use, rub the mixture on the scale with the palm of the hand till the metal is white (taking care not to put on too much), rinse in clean water, and brighten up with common whiting; rinse again and dry in boxwood sawdust, and lacquer. For a better protective coat, instead of lacquer take one part methylated spirit, two parts of white hard varnish, shake and mix well, and put on with a clean white rag folded fourfold and used edgeways. Take care when heating the scale only just to steam off, or the wax will draw.

Thimbles

Silver thimbles are generally soft and thin, and in time the needles wear holes in the end. To repair thimbles worn in this way, the silver end can be replaced with an end of ivory. This may be carried out as follows: Cut off the worn end by filing round the corner, levelling the top, and removing all burrs. Measure the outside diameter, and cut an ivory disc a little larger than this and about $\frac{3}{16}$ in. thick. Smooth one side of the disc, and lay the thimble on it small end down. Now, with a darning needle scribe the inside diameter of the thimble on the disc. Carefully check the edge of the disc down to the scribed line, leaving it just tight enough to press fairly firm into the end of the thimble. Those possessing a lathe will find no difficulty in this little job. Fig. 556 shows how the edge may be checked. A piece of sheet iron A, $\frac{3}{4}$ in. by $\frac{3}{8}$ in., should be knocked over $\frac{1}{8}$ in. on one edge. This, with the disc B, is held between the finger and thumb and a smooth flat file C, with a safe edge, carefully used, gradually turning the disc round and keeping the safe edge against the metal guide. Cement the disc in with Seccotine, and, when dry, round over the top and polish with whiting and water. With a pen and ink mark dots in rows upon the end, and when dry push the thimble on a piece of wood shaped to fit the inside,

and fix it upright in a vice. Next get a small drill, fix it in a wood handle, and, by taking each dot as a guide, carefully rotate the drill between the fingers. Keep the drill very sharp, and take each depression to the same depth. Polish off all burrs, and the job is finished. If a thimble is too small for the user, it may be enlarged by first cutting off the end and then hammering it lightly on a polished tapered mandrel held in the vice horizontally. The hammer should have a polished, slightly convex face, and should not weigh more than a few ounces.

Tiles

Cleaning Floor Tiles.—If the tiles are glazed, a rub with a dry or slightly damped flannel is all that is necessary. Unglazed floor tiles occasionally present a white scum on the surface, caused by the evaporation of the lime and cement used in the foundations. In cases where the tiles have been laid on new foundations, this scum may continue appearing for some months. The floor is not injured by this, however, and it may be easily removed. Floor tiling should be cleaned two or three times a week with soft soap dissolved in tepid water and applied with a hand scrubbing-brush. Paint spots or similar stains, and also cement marks, may be removed by pouring on them a small quantity of sulphuric acid diluted with an equal quantity of water, and allowing it to remain for a few hours. It should then be washed off, and, if necessary, again applied till the stain has disappeared. For removing ink stains, use nitrous acid in place of sulphuric acid. Particular care should be taken when using these acids, as they will burn both hands and clothes. A piece of old flannel may be used for washing the acid from the tiling. For cleaning tiles generally, good results are obtained with hydrochloric acid (spirit of salt) diluted with water (the requisite strength may be found by trial), well scrubbing the tiles with an old stump brush until clean. If this does not remove the whiteness, and there is much grout left on the tiles, try rubbing with a piece of York gritstone and fine sand and water.

Cutting Tiles.—To cut a tile into two pieces a chisel is needed, and the tile, which must be flat, is laid on a soft wood board and cut very carefully. To reduce the size of a tile, or to take an irregular-shaped piece out of it, break or pinch off pieces with a pair of carpenter's pincers about 7 in. long. The edges can be rubbed down on a stone if required to be very neat. For cutting a ridge tile, mark the place at which the tile is required to be cut, notch round the outside and the two lower edges with a hard sharp chisel, then tap round the inside with a hammer opposite the notch and the tile will come in two. Thin tiles may be embedded on sand while being notched. When there is a difficulty in cutting the hard outer skin of the tile,

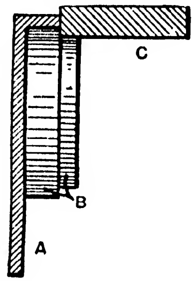


Fig. 556.—Repairing Silver Thimble.

the corner of the chisel or a point may be used. Cuttings of under 2 in. should be avoided, as there is a liability of breaking the tile; to avoid these, three or more tiles may be cut as required to fill in the space. Slate ridges may be cut with a joiner's ordinary tenon saw.

Fitting Tiles over Hearthstone.—(1) Tiles may be laid on an existing hearthstone with satisfactory results, but before laying the tiles a kerb must be formed along the hearth margin, composed of stone, marble, or iron, which should be permanently fixed. The tiles themselves must be fitted in position close up to the kerb and grate, and bedded in Portland cement, 1 part, and washed sand, 2 parts. The superfluous cement must be cleaned from the face of the tiles immediately after laying, for if allowed to get dry it is difficult to remove. (2) In a case where an iron kerb,

or a fender without a bottom, is to be used, first place the kerb on the hearth in the position it is to occupy, and mark with chalk or pencil round the inside edge of the kerb and the outside of the jambs and grate, including the space for the ashpan. If it is a bedroom grate, take this right out, and remove the kerb. Now arrange the tiles to suit the marks made, remembering that the grate is to stand on the tiles, so keep them beyond the marks at the back. If the hearth at the back of the grate is hollow in places, brush out all dirt, wet well, and float in plaster-of-Paris, striking off level with a stick. When the plaster is set, relay the tiles and replace the grate. After laying the remainder of the tiles to the marks in front, screw a narrow strip of wood on each side and along

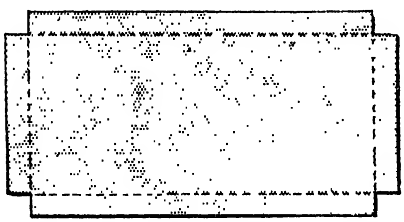


Fig. 557.—Iron Tray to receive Hearth Tiles.

the front of the tiles, making three sides of a frame and holding all tight. The kerb can then be laid down or lifted as required for cleaning, and the tiles can be lifted on removal day without any trouble. The narrow tiles, 6 in. by 2 in., are easily cut when necessary by notching them with the edge of a coarse half-round file straight across the back of the tile, and then snapping them with the two hands, just as one would break a piece of glass that has been marked with a diamond. It will be seen that by the above method no cement is required to bed the tiles in. (3) Procure a piece of sheet-iron, which should measure $\frac{3}{8}$ in. more all round than the area to be covered by the tiles, and form it into a tray by cutting the corners as shown in Fig. 557 and turning up $\frac{3}{8}$ in. of the edge all round. The tiles are then fitted tight in the tray, and the tray, with the tiles in position, simply laid on the hearthstone. They can thus be easily removed at will.

Fixing Tiles in Hearth.—In laying the tiles, the hearth is first formed and floated true with a composition of 1 part of Portland cement to 2 parts of washed sharp sand. The surface of this is made $\frac{1}{2}$ in. lower than the finished hearth is to be. This is done the day before the tiles are laid, so as to allow the cement time to set hard. Previous to laying the tiles, soak them in water for an hour, and well wet the surface of the prepared cement hearth before placing the tiles down. The tiles are laid with neat Portland cement.

Fixing Tiles to Iron.—If the iron surface is any part of a kitchen range, or other hot apparatus, the tiles cannot be made to adhere satisfactorily whatever cement is used, and the only good means of fixing them is to drill and tap holes in the plate to receive screws at the corners of the tiles. Suitable screws with washers can be readily obtained. The screw does not go through the tiles, but comes outside the extreme angle, so that one screw and washer will cover and secure a corner of four tiles where they meet. If the iron surface is always cold, then probably red- and white-lead will prove as good as anything. Mix moist white-lead and dry red-lead to the consistency of very soft putty. Thin a small portion with boiled oil to paint consistency, and with it paint the surface of the iron and the backs of the tiles. Now spread a thin layer of the lead putty on the back of a tile, and press it firmly on to the iron surface; the tile will adhere at once. The work will dry and set hard in a few days.

Fixing Tiles to Mantelpiece.—If the tiles are to be fixed on the masonry direct, allow them to soak in a bucket of water and wash off every trace of cement that is now on. Well damp the masonry and lay on it a bed of Portland cement to which a small portion of sharp sand has been added or, instead of this mixture, use plaster-of Paris. Lay the bed for one tile only at a time, or the cement may set too quickly Fit the pieces carefully together in their beds and afterwards point between the tiles and in the cracks with fine plaster. When this is dry, to disguise the cracks, touch

with oil colour; a line of black paint $\frac{1}{8}$ in. wide between the tiles will also improve the appearance. If the tiles are to be fixed on woodwork, provide a piece of slate as a back, and on that proceed as before.

Fixing Tiles in Range Openings.—The only really satisfactory method of fixing tiles in range openings is to nip a little piece off the corners of the tiles, and then, as they are put up, cement in a brass-headed nail (with split or bent shank) where the corners of four tiles come together. Ordinary cement is now used, the backing being well made and wetted, and the tiles soaked in the usual way. Plain iron covings with the tiles secured by corner screws offer the only really successful way of tiling round range openings. In every case there should be a 7-in. or 8-in. iron skirting round the hot plate to prevent the tiles being struck by saucepans, etc.

Fixing Tiles to Shop Walls.—Before the tiles can be fixed it will be necessary to chop or otherwise rough the old plaster to form a key for the new material. Portland cement should be used to fix the tiles. First wet the wall, then put on a coat of cement about $\frac{1}{2}$ in. thick and, say, a few yards square, and level it. When the cement is set, but not dry, the tiles can be fixed. For some time previous to fixing, the tiles should be soaked in water, otherwise they will not adhere. While the tile is quite moist, spread a little cement over the back and bed the tile on the wall. Proceed to do this until the newly cemented part is covered. Then proceed to cement another section of the wall, and get it ready, as before, to receive the tiles. What has to be aimed at is to have every surface moist, yet not so wet as to give trouble by its softness. It is of little use fixing up tiles if they, or the surfaces they go on, are dry.

Fixing Tiles Round Sink.—Before fixing the tiles the wall must be made approximately level, either by bringing the face forward by additional plastering, or setting the pipes farther back. White glazed tiles are usually employed, about $\frac{3}{8}$ in. thick, and before use they must be well soaked in water to stop suction. Having the old wall or new plastering roughened to form a key, lay over it a thin coating of Keene's cement, and upon this bed the tiles, keeping the joint-lines straight and the face of the tiling level by means of a straightedge. It is usual to fix a wood beading round the edges of the tiling, but, if preferred, the cement may be splayed off instead.

Fixing Tiles to Wooden Table Top.—An elastic cement will be required on account of the shrinkage and expansion of the wood. Try Prout's elastic glue or Ellis's liquid fish glue. The following has also been recommended: To 4 parts of good glue, prepared in the usual way for carpenter's use, add, and boil in, 1 part of Venice turpentine.

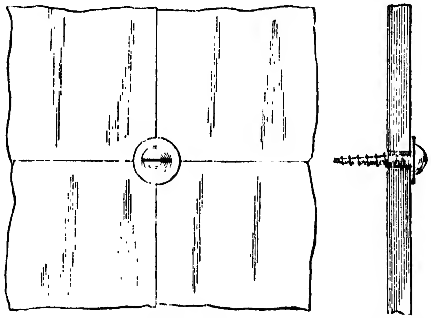


Fig. 558. Fig. 559.

Figs. 558 and 559.—Screwing Tiles to Wood Back.

Fixing Tiles in Washstand Back.—Unless the back frame is iron, and rigid, the tiles cannot be cemented in with any great degree of success. White-lead or glaziers' putty, made into a rather pasty condition with boiled linseed oil, must be used. The background will first have to be thickly painted and the tiles bedded on while the paint is sticky. A good time must be allowed for drying. The best method of fixing tiles on a wood back is to use round-headed screws at the corners as illustrated by Figs. 558 and 559.

Fixing Tiles to Washstand Top.—The top of the washstand should have the margin fixed so that the tiles are exactly the size to fit in, between the margin, and the sinking the exact thickness of the tiles. The tiles are then laid in, and the joints filled in with plaster-of-Paris in liquid

form. No other fixing is necessary for horizontal surfaces. Plaster-of-Paris is generally used, but Portland cement resists the action of the water much better. If the dark appearance of the cement is objected to, the joints can be raked out to a depth of about ¼ in. and then pointed with plaster-of-Paris. But this material soon presents a dirty appearance.

Fixing Tiles to Wood Floor.—If the tiles are to be laid on a boarded floor, probably a mastic, composed of pitch 1 part, Stockholm tar 2 parts, and chalk lime ¼ part, will be most suitable; this mixture will have a certain amount of elasticity that will allow for the yielding of the floor. But if the base is a solid block floor, use a bedding of ordinary lime cement; the tiles in this case should be wetted when laid. Whether a wooden floor so covered will succumb to dry rot is a moot point. It probably will.

Removing Cement from Floor Tiles.—To remove cement from floor (unglazed) tiles it will be necessary to scrape and rub them. The cement is in the pores of the tiles, and it is well known that glazed tiles which have been laid are difficult to use again if taken up, owing to the impossibility of getting the cement off their backs. Unglazed tiles can be brightened by the use of paraffin, and the smell goes off in about two hours. The paraffin need only be applied sparingly about once a month. Animal or vegetable oils are too thick, and inclined to dry as a film on the surface, whereas paraffin soaks in. There is no means of removing cement that has soaked into the pores of the tile; anything that would dissolve or eat out the cement would injure the tile.

Removing Cement from Hearth Tiles.—Spirit of salt has been recommended, but it is of little aid, and no solution seems to have much effect. The best way is to lay the tile on a solid bed and then, with a sharp, thin steel chisel and a light hammer, chip off the cement. Great care must be exercised, or the tiles will be broken. A method that has been recommended is to rub the tiles on a flagstone with sharp sand and water.

Removing Tiles from Tiled Hearth.—The only safe method of removing tiles from a tiled hearth without damaging them is to take away the margin at the end of the row and insert a steel chisel under the tile. When one row of tiles has been removed the remainder easily follow. If for some cause the margin cannot be removed, or if a marble kerb that must not be disturbed surrounds the hearth, one of the tiles must be broken in order that the chisel may be driven underneath. Commence from the outer row. The following has been highly recommended: Use a cutting chisel drawn out thin and inserted in the cement between the tiles and the hearthstone. Strike it gently with a hammer till the tiles are loose, commencing at one corner, and taking in order the tiles that have two sides free. If they are very hard to move, a narrow chisel might be inserted in the joints; but it must not come up to the top of the tiles, or it may break a piece out. Great care must be taken.

Tin

Tin (symbol Sn, and atomic weight 118) has a specific gravity of about 7·3 and a melting point of 442° F. (227·7° C.). Whilst being more tenacious and ductile than lead, it is less so than zinc, as regards both of these qualities; and though more malleable than aluminium, it is less so than copper. A cubic foot of tin weighs nearly 456 lb. Tin has nearly the lustrous whiteness of silver, is highly malleable, harder than lead, but is not very tenacious. It oxidises only on being heated, when it forms stannic oxide. Tin can be dissolved by many acids, and easily alloys with most metals. The tin known to the metal-plate worker is not solid tin, but steel plate thinly coated with tin. Many of the more important alloys have tin as their principal constituent; some of these alloys are solders. Tin occurs in the form of sulphuret and oxide, but more generally in the form of ore, known as tin-stone. This is smelted either in blast or reverberatory furnaces. Grain tin is made by allowing the molten metal to fall from a height on to a hard, cold surface. To produce what is known as "common" tin, the metal as smelted passes at once to the moulds. "Refined" tin is the result of using better ores and

lengthening the poling process (stirring with a pole of green wood). The purest metal in the mould is the upper portion; the middle portion is the "common," and the bottom portion is too impure for use at all, and requires another fusing and poling. The ingots are known as "block" tin.

Blacking Tin Plates.—Cleanse the plates or other articles from all grease and oil, and then immerse in a bath composed of butter of antimony 1 part, chloride of copper 2 parts, and water 32 parts. When the desired colour has been obtained, wash and dry the plates or articles, and then apply a coat of colourless lacquer such as Zapon. Another method is to cover the articles with black "Opaline," which gives a colour coating that is lustrous and waterproof, is readily applied, and becomes quite hard if exposed for a short time to a gentle heat.

Casting Tin.—When only a few small tin castings, say three or four, are wanted, a good plan is to make a mould from Parian cement, using the article as pattern and casting the others in this mould. First make a small wooden frame sufficiently large to allow a margin of 1½ in. at each side of the pattern and on the top and bottom. This frame must be well greased on the inside to allow the mould to leave freely. Place the frame on a piece of glass, and, after making a cream of Parian cement and water (well beaten up to remove air bubbles), pour the cream in the mould frame on glass to a depth of 1¼ in. and allow it to get cold. See that the pattern is also well greased, and then place it in the centre of the frame, running in more cream till the pattern is exactly half covered. Allow this to dry well, and, after trimming out a couple of check ways so that the mould halves fit well together, rub the dry surface with grease, preferably vaseline, and cover the latter with a further quantity of cream till a thickness of 1¼ in. is made over the top of the pattern. Allow this to get thoroughly dry, when the plaster mould will leave the wooden frame, and should also part easily at the middle. The pattern can be removed, and the gates next put in with a rough file. The mould must be absolutely dry before use or it will undoubtedly crack. The two halves can be put together and held in place by a small wooden cramp, when the molten tin may be poured. If a large number of castings are to be made, it would be well to have an iron mould prepared by any local iron-founder.

Frosting Tin.—A frosted or crystallised effect on tin or tin-plate, resembling watered or moiré silk, is named moiré metallique, and can be produced by heating the metal on a hot piece of iron until a drop of water will fizz on its surface. The part to be ornamented must then be washed with a mixture of 4 parts water, 1 part nitric acid, and 1 part hydrochloric acid. Rinse the plate in water to clear it of acid, dry in hot boxwood sawdust, again make it hot, and lacquer with transparent lacquer if the colour of tin is to be preserved, or with lacquer tinted with annatto or some aniline yellow dye if the colour of brass is desired. Next stove the article to harden the lacquer, and thus complete the process. The design will vary with the heat of the tin-plate at the time when the acid is applied. Parts to be left plain should be outlined with blacklead pencil and coated with copal varnish before putting on the acid mixture. The varnish may be dissolved off with warm spirit of wine after the acid has done its work.

Gold Colouring on Tin.—Tin can be given a gold colour by means of lacquer, which can be made in almost any colour by using appropriate stains. A pale gold lacquer is made by dissolving 5 oz. of orange shellac and ¼ oz. of gamboge in ½ gal. of methylated spirit; for a deep gold lacquer, dissolve 5 oz. of orange shellac, 2 oz. of turmeric, 2 oz. of gamboge, and ¼ oz. of dragon's blood in 3 pt. of methylated spirit. When applying the gold lacquer the tin-plate should be thoroughly cleaned with soft soap and hot water, dried in sawdust, heated on an iron plate until the hand can just bear the heat, and the lacquer applied with a long-haired camel-hair brush in long, straight sweeps, so that the coating may be even and free from streaks.

Phosphor Tin.—In making phosphor tin, use an iron gas barrel, about 2 ft. long and 1 in. internal diameter; it must be pro-

vided with a screw cap at one end, the other being open. The sticks of phosphorus may be removed from the bottle, dried very carefully by gentle pressure between blotting-paper, introduced into the tube by tongs, and then a plug of tin inserted. When the tin in the crucible is melted it may be stirred for a few minutes with the iron rod; the tin plug will melt out and liberate the phosphorus into the molten metal. The phosphorus must not on any account be handled. Phosphor tin contains less than 1 per cent. of phosphorus, usually about ½ per cent., but more than this must be taken because some of it will burn off; keep the surface of the tin covered with a little borax.

Polishing Tinware.—First scour the surface of the tin with a greased rag mop attached to the nose of the shaft of a polishing lathe, then clean bright with a dry mop dusted over with Sheffield lime. The lathe should be run just fast enough to cause the linen mop to stand out stiff; the tinned surface will then undergo no deterioration. If a polishing lathe is not available, make a thin paste from the finest flour emery and paraffin, and, using a pad of ordinary house flannel, scour the metal clean; then dust over with whiting, and clean up bright with an ordinary duster. If the articles are not required very bright, they may be dusted over with whiting, and then cleaned as above, the preliminary scouring being omitted.

Recovering Tin from Tin Scrap.—The usual method of recovering the tin from tin scrap and from old tin articles which have soldered joints is to heat the articles to a temperature well above the melting point of tin, and to continue the heating until the metal is nearly all drained off the iron. This may be effected on a small scale as follows:—Arrange an iron pan to catch the tin, and on top of the pan place a number of cross-bars to support the cuttings; round the sides of the pan erect a loose brick structure large enough to hold any convenient combustibles, the tin cuttings, etc. Now place a layer of wood on the grating over the pan, and fill up the brick enclosure with the cuttings intermingled with wood and other combustibles. Fire the wood at the bottom, and, as the mass settles down, add more fuel and cuttings as needed. The tin found in the pan is usually remelted with a proportion of lead to form ordinary solder. To free the tin from dirt and other impurities, after remelting, throw into the molten metal some sal-ammoniac, and well stir. Then allow the metal to stand tranquil for a short time, skim the dross from the surface, and add lead in suitable proportion to form solder. (For the correct proportions, *see* Soldering.)

Sheet Tin (*see* Tin-plate).

Tinning

Boiling White.—By tinning, or "boiling white," a thin coating of tin may be applied to small articles made of brass and copper. Ordinary pins are sometimes treated in this way as a final preparation, thus giving them their brightness. In circumstances when the colour of brass hinges or nails would not match the object for which they were intended, this method of tinning would render them fit for their purpose and save purchasing things made of a white metal. Similarly, small parts of artificial baits used for sea- or fresh-water fishing can be easily tinned; this makes them shine in the water, and renders them more conspicuous to the fish. Tackle-makers and others may therefore make brass swivels and other oddments of tackle appear like silver and permanently bright. The method is extremely simple: a piece of block tin, weighing about ½ lb., must be obtained from an ironmonger. Melt this in an iron ladle, and whilst liquid pour the metal into a bucket about half full of cold water. In pouring the molten tin, the ladle should be held at some height above the water, and it is desirable to stand on a chair. If not poured into water, the tin would be spilt. The tin, immediately it touches the cold water, forms "grain" tin, spreading and assuming a flaky consistency. Having drained off the water from the bucket or pan, a box (without a cover) must be made of perforated zinc to contain the tin. A piece about 1 ft. square will make a box large enough for small articles, for which boiling white is specially convenient;

but there is no reason why it should not be practised quite satisfactorily on a larger scale. Having marked out the size of the box, cut out the square piece at each corner with snips or strong scissors, and when the sides are turned up all round, which is easily done with a mallet or hammer over an iron stake, the edges will meet. To keep the four corners of the box together, small pieces of fine copper wire should be inserted through the holes in the zinc and twisted tightly with the fingers. Having made the box, which need only be a rough affair, put about half the grain tin into it. Then place upon this the small brass articles, and on the top of them the remainder of the tin, so as to cover them. For ease of examination, it is better, if possible, to string or attach the articles to a piece of copper wire, the two ends of which are left projecting from the top of the box. The brass should be chemically clean, as it will take the tin more readily, and, if lacquered, the lacquer should be removed by boiling in caustic potash. Before tinning, the articles will be further improved by holding them in dipping acid for about a second, then immersing immediately in clean cold water. If this is not very rapidly performed the metal will turn black. When the things have been prepared and placed in the zinc box amongst the grain tin, the whole is boiled in a saucepan nearly full of water ; a saucepan enamelled inside is to be preferred. Whilst the water is boiling some cream of tartar should be liberally sprinkled on the top of the tin. The process of boiling will occupy nearly half an hour, and if the water in the saucepan becomes insufficient, more should be added. The boiling can be done over an ordinary fire, but a gas burner is handier in a workshop. By examining the articles it is easy to ascertain when they have received sufficient coatings of tin, as then they will appear of a uniform dull grey colour. If not, the boiling must be continued for another five or ten minutes until the brass is no longer visible. Then take them out, rinse in clean water, and dry with a cloth. A rub up with washleather will quickly render them brilliant, and they will look as if they had been nickel-plated. The grain tin should not be thrown away, as it can be used again and again. As this is a rather lengthy process, it is a good plan to boil as many articles as possible at the same time.

Tinning Brass by Immersion.—The "boiling white" process has already been noted. Other immersion processes are: (1) Immerse the brass in a saturated solution of tin made by boiling peroxide of tin with a strong aqueous caustic potash solution. (2) Roseleur's method is to immerse the brass, supported on a perforated zinc tray, in a solution of 1 part of chloride of tin in crystals, and 6 parts of pyrophosphate of sodium in 300 parts of distilled water. When the brass is immersed boil the solution, which should be occasionally stirred. The brass should also be slightly moved during the immersion. Scrape the perforated trays after each operation so as to ensure perfect contact in the next.

Tinning Butchers' Hooks.—Butchers' hooks are coated with tin by immersion in the molten metal. They are pickled n hydrochloric acid until the whole of the black scale is dissolved from the iron, then rinsed in water, and afterwards dipped in chloride of zinc (killed spirit). The hooks should next be immersed in a plumber's pot containing molten tin, the superfluous tin being wiped off with a pad of tow or wadding. If the tin fails to adhere on any part of the hook, again immerse it in the metal, withdraw it, and, while the tin is flowing on it, rub the uncovered part with a lump of sal-ammoniac ; again immerse the hook, and wipe off clean as stated above.

Tinning Copper.—If the copper is to be tinned on one side only, first smear with salt and water the side that touches the fire ; then, with a pad of tow on which killed spirit has been sprinkled, wash the other side of the metal ; also sprinkle a little powdered sal-ammoniac over the surface. Place the sheet over the fire, and when the metal is hot enough rub on it the end of a strip of the purest tin until a small portion of the tin melts ; then with a pad of tow or wadding, on which sal-ammoniac has been sprinkled, rub the molten tin quickly over the entire surface of the hot copper.

Now, with a pad of wadding saturated with oil, wipe off smooth all the superfluous molten tin from the copper surface. If the copper is to be tinned on both sides, an iron bath of semicircular section, built up over a fire grate, should be used. Having melted a sufficient quantity of tin in the bath, prepare the copper for tinning with killed spirit and sal-ammoniac as above; pass the copper through the molten metal, and as it is withdrawn quickly wipe the superfluous tin from both surfaces with a pad of oily wadding. Plunge the tinned metal in cold water, and scour up bright with flannel and a thin paste, formed by mixing together flour emery and oil. Clean this off, and rub the tin bright with clean cloths. If the tinning is to look as bright as tinned iron plates, try the process adopted for tinning plates. The latter, after the removal of the surplus tin, are immersed in tallow heated to a little above the melting point of tin; the tin on the surface then melts again and flows evenly all over the work.

Tinning Copper Bit.—A copper soldering bit must be kept well tinned or it will not work properly. To re-tin a copper bit, heat the copper as though for soldering, file the parts to be tinned, put some resin on a soft brick, and rub the filed parts on the brick and in the resin, which the heat of the copper will melt. While rubbing the copper on the bit, press a piece of "fine" or "half-and-half" solder on the part to be tinned, and a film of solder will adhere to the copper. The surplus resin will adhere to the brick, and the surplus solder will remain on the resin. To re-tin the bit when necessary, again file the copper and rub it on the brick. The resin and solder already there will suffice for several operations, and more resin and solder can be added as required. Tinning the copper in this way is best effected when it is barely hot enough to melt the solder. If it is too hot, the filed parts tarnish or oxidise before the resin and solder can be applied. Or the filed copper can be rubbed on a block of sal-ammoniac and the solder applied; or it may be dipped in "killed" spirit of salt and applied to the solder. In these two ways the copper is eaten away very quickly by the sal-ammoniac or the spirit. Resin is the best flux to use. This matter is also referred to under the main heading "Soldering."

Tinning Copper Stewpans and Cooking Utensils.—The object of tinning copper stewpans is to prevent chemical action on the copper, which may be injurious to health. It also gives a much better appearance to copper cooking utensils, besides facilitating their being kept clean. To ensure success in re-tinning, the article must be perfectly free from grease or dirt—in fact, it must be chemically clean. For this purpose, first burn off all grease and dirt over a forge fire or with a blowpipe until the article is heated to a dull red colour, being particular where the handles are riveted on. Now wipe out the inside with a small pad of tow, and set down to cool, and when cold, thoroughly scour the inside with wet rough sand or powdered coke until it becomes clean and bright. If the dirt has eaten into the metal, or if the surface is very black, wash it with raw spirit of salt (hydrochloric acid), using a piece of tow tied to the end of a short stick. Rinse with cold water, and then scour bright. When perfectly bright, wash the article well with cold water, taking care that no grit or sand remains inside, and then dust the inside with powdered sal-ammoniac. The outside must be prepared by coating it with a mixture of salt and whiting, which should be of the consistency of cream; this prevents any tin adhering to the outside. If the top of the outside requires to be tinned to the depth of about 1 in., as is the case with all new stewpans, it should be thoroughly cleaned as before explained. A band of tin 1 in. deep should be tightly held round the top of the stewpan, while the mixture of salt and whiting is rubbed over the stewpan below the band. Now remove the band, and dust the bright surface of the stewpan, formerly covered with the tin band, with sal-ammoniac. A rubber, by which the molten tin is manipulated over the copper surface, is made as follows: Coil the end of a piece of ¼-in. wire, about 18 in. long, until it is about 2 in. in diameter, tin the coil by soaking it in raw spirit of salt for some time, and then dipping it in a saturated solution of sal-ammoniac

and killed spirit (chloride of zinc), and vigorously rubbing on block tin or tinman's solder. Place the stewpan over a forge fire, and in it drop a small quantity of pure block tin about the size of a pigeon's egg. The tin will soon melt, after which it must be rubbed over the copper with the rubber until the surface of the copper alloys with the tin. Any difficulty in getting this result may be overcome by repeatedly and alternately dusting with powdered sal-ammoniac and vigorously rubbing over the tin with the rubber. The top of the outside of the stewpan may be easily tinned with a soldering bit, the solution of sal-ammoniac and chloride of zinc being used instead of the powdered sal-ammoniac. Care should be taken that the article is not allowed to get too hot. The maximum heat is obtained when the molten tin can be rinsed round the inside of the article. The molten tin is then quickly emptied out into another pan, if more than one is to be tinned, and the pan quickly wiped out with a pad of clean tow, which will remove any superfluous tin, after which it must be suddenly plunged into a vessel of cold clean water, and then dried by rubbing with clean hot sawdust. When pouring molten tin from one pan into another, great care should be taken in seeing that the pan into which it is to be poured is perfectly dry and warm, otherwise the possibility of the tin flying will make the operation highly dangerous. If a stewpan, ladle, spoon, or strainer requires to be tinned all over inside and out, it should be thoroughly cleaned, and the inside and outside should then be treated with saturated solution of sal-ammoniac and killed spirit of salt, and next dusted over with powdered sal-ammoniac. A vessel containing molten tin should now be in readiness, into which the article should be carefully plunged and washed. The article is then wiped with tow, plunged in cold clean water, dried with hot sawdust, and polished with whiting.

Tinning Dish Covers.—The process of retinning dish covers is described below. First thoroughly clean the parts where the tin has worn off by scouring with wet sand. Now immerse the cover in hydrochloric acid for a short time, rinse the raw acid off in clean water, and then pickle in killed spirit. With a gas blowpipe flame gently heat the cover from the inside until the melting point of tin is reached, then rub a strip of molten tin over the untinned parts of the cover until they are coated, and then work the molten tin over the whole of the surface with a pad of wadding upon which some powdered sal-ammoniac has been sprinkled. This part of the process should be performed as quickly as possible, the superfluous tin being wiped smoothly down towards the edge of the cover, and then from there wiped off quite clean. The cover, after cooling, should be scoured with oil and fine emery powder and polished with whiting. Much better results can be obtained by immersing the cover in molten tin after pickling, allowing the tin to drain down to the edge, and then wiping off the spare metal from there.

Tinning Iron Articles.—The articles should be pickled in warm sulphuric acid or hydrochloric acid until all scale is removed, and then rinsed in clean water. Should there still be any little black spots showing on the metal, they must be removed by further pickling, or by scrubbing them with a hard brush and a little fine sand until the iron presents a clean grey uniform surface. The articles are then immersed in chloride of zinc, and on removal from this are dusted over with sal-ammoniac. They are now ready for immersion in the molten tin. If the articles are required to be highly polished, the surplus tin should not be wiped off, but should drain off alone. A brilliant polish is then given by working over the tinned surface with a rag mop attached to a polishing lathe, the mop being dusted over with polishing lime.

Tinning Lead Pipes. The tinning of lead pipes is of especial importance when the pipes are to hold water. For tinning cast lead pipes, the tin is sometimes poured into them while they are still hot, and distributed over the surface by rubbing with tow rolled in colophony (resin) or moistened in turpentine. The outside of the pipe is similarly treated. Sometimes the hot pipes are coated over with resin inside and out, and then put through a tin bath. A more

modern method is as follows: Within an iron cylinder, into the bottom of which is fitted the piston of a hydraulic press, is cast a leaden cylinder. The iron core is removed, and replaced by one of less diameter, and molten pure tin poured into the free space. Over the top of the iron cylinder is fastened a plate with a circular opening, which fixes the outer diameter of the pipe, while the iron core fixes the inner diameter. The hydraulic press being set in motion, a lead pipe coated on the inside with tin is forced out through the opening in the plate. Tin-plated lead pipes can also be made by pouring molten lead into a rapidly revolving mould, and pouring in molten tin after the lead has hardened. The centrifugal force developed by the rapid motion of the form throws the tin against the sides of the pipe. But the method given previously is preferable, and almost all lead pipe is made in this way.

Tinning Lead Sheets.—For tinning sheets of lead, "plating" is the best method. A table is employed, having a horizontal and perfectly smooth iron top; a raised edge prevents the metal from running off. The lead is poured out on the table, and then covered with grease to prevent oxidation. After it has cooled, molten tin is poured over it, so hot that the surface of the lead is melted again, and intimately united with the tin. When the sheet is cool enough, it is turned over, and plated on the other side. It can be rolled out very thin without injury to the tin coating, and is suitable for lining boxes for chocolate, tea, tobacco, confectionery, etc. If sheets of lead are to receive only a superficial tinning, they are made hot, strewn over with powdered colophony, and molten tin is rubbed on with bunches of tow.

Tinning Plumbers' Brasswork.—Plumbers' brasswork should always be prepared for soldering to by tinning the parts to be soldered, resin being used as a flux. Killed spirit should not be used, because the zinc gets into the wiping solder and "poisons" it, so that it is difficult afterwards to make a joint with it. If the tinned parts turn black when wiping a joint, it shows that the solder is used much too hot. Cheap brasswork contains an excess of zinc. Zinc will not properly alloy with solder, and if the solder is used too hot it melts some of the zinc in the brasswork. If solder is made red hot, the tin will float to the surface, where it is exposed to the atmosphere, absorbs oxygen, and is converted to what is commonly called dross. The solder is thus robbed of a portion of its tin, which has a considerable influence on the temperature at which the solder is rendered so plastic as to be easily moulded into the form of a wiped joint.

Tinning Reflectors.—If the tin is worn off some reflectors, they may be re-tinned in the following manner. Separate the reflectors from the other parts of the lamp, and remove all dents and scratches by beating, rubbing, and polishing, so as to get an even polished surface. Then place a few grains of pure grain tin and a small piece of tallow in the hollow of each reflector; also get a wisp of tow and grease this with tallow. Hold the reflector in a pair of pliers over the flame of a spirit lamp or of a Bunsen gas-burner until the tin melts, then spread it evenly over the surface of the metal by wiping it whilst hot with the greasy tow, finally wiping off all excess of tin and placing aside to cool. When cold, clean and polish in the usual manner with best plate-powder.

Tinning Spout of Copper Kettle.—Pickle the spout in weak sulphuric acid until all the borax is dissolved, then rinse it in cold water and dry it. Pour some killed spirit through the spout, and also shake through it a little powdered sal-ammoniac. Now melt some tin in a plumber's ladle, and, holding the spout with a pair of tongs over a suitable vessel, pour the molten tin through the spout two or three times until the interior is properly coated. Another method is first to prepare the spout as above, then coat the exterior with a mixture of whiting and water or salt and water; when this dries the spout may be immersed in molten tin, removed, and the tin drained from it, the outside being cleaned up bright after cooling.

Tinning Steel Springs.—Steel springs may readily be tinned by first depositing on them a very thin coat of copper by electrolysis. The tin should be applied in the

usual manner; that is, by means of cream of tartar, grain tin, and water, the articles being boiled in this solution (*see* "Boiling White," a paragraph on p. 512). Another, but somewhat more tedious, method is to make an amalgam of tin and mercury to a soft paste. After thoroughly cleaning the steel, rub it with a cloth moistened with hydrochloric acid, and immediately apply a little of the amalgam to the surface, rubbing it with the same rag.

Tinning Wire.—The usual method of tinning copper wire is to draw it through a bath of molten tin, which is kept at a uniform temperature, etc., and is protected from the air by a layer of tallow or similar fat. The wire is first thoroughly cleansed from dirt and grease by dipping in oil of vitriol (sulphuric acid), afterwards rinsing in water and drying in sawdust. The wire is unwound from a drum and drawn through the tin, then passed through an apparatus that removes the excess of tin, and is finally wound on another drum. Wire that is to be used for special purposes should be tinned with pure tin.

Tinning Zinc.—Zinc articles can be tinned very simply and easily. Prepare a mixture of 2 parts of tin chloride, 2 of purified tartar, 4 of water at 75° C. (167° F.), and enough of the finest sand to make a pulpy mass. Apply this with a sponge or brush to the articles. The tin coating will at first be dull grey, but rubbing with clay and sand will bring out the fine lustre characteristic of polished tin.

Tin-plate

"Tin" used in sheets by the tinman and sheet metal worker is actually steel with a thin coating of tin applied by passing the cleaned steel plate through a bath of molten tin. The tinned steel plate is correctly designated "tinned-plate." Tin-plates measuring 14 in. × 10 in. are known as singles; 15 in. × 11 in., middles or small doubles; 17 in. × 12½ in., doubles; 20 in. × 14 in., large doubles or twenties. Larger sizes are known by their dimensions, such as 28 in. × 20 in., 30 in. × 22 in., 40 in. × 20 in., etc., etc. Tin-plates are made in various thicknesses, and these are denoted by the number of crosses on the box in which the plates are packed, as shown in the following table:—

Thickness in inches.	Thickness. B.W.G	Thickness. Trade Terms.	Weight in lbs. per sq. ft.			
			Tinned Steel	Copper	Brass.	Zinc.
·012	30	IC	·48	·55	·52	·42
·014	28	I ×	·56	·69	·65	·56
·016	27	DC	·64	·83	·79	·62
·018	26	I × ×	·72	·92	·87	
·020	25	I × × × ×	·80	·97	·92	·71
·025	23	D × × ×	1·0	1·29	1·22	·93
·028	22	D × × × ×	1·15	1·34	1·27	1·06
·032	21	D × × × × ×	1·29	1·52	1·44	1·12

The nomenclature of tin-plates is very misleading. In the trade, tin-plates are known either as "charcoal" or "coke," but the real meaning of these terms has not any modern reference, nearly all tinned plates being made either of Bessemer or Siemens steel. Only a very small proportion, both in Great Britain and America, is made actually from charcoal iron, although a large proportion of the tin-plate product is offered under the name of charcoal plates. The suggestion that tin-plates should be known either as "Bessemer" or "Siemens" has much to recommend it. The tin-plate trade term "IC" (*see* the first line of the table above) is used to designate the weight of tin-plates, and it dates almost from the beginning of the industry. At that time it denoted the weight of a box of 225 10-in. by 14-in. plates weighing 112 lb., or the English hundredweight, which was commonly abbreviated "cwt." This term later was further abbreviated to IC, representing a box of tin-plates weighing 112 lb. The term IC has long represented a base box of 108 lb., this being used as a standard both in the United States and Wales to-day.

Tobacco Pipes

Amber Pipe Stems. Amber pipe stems after being tooled out are bent to the required shape. They are first immersed in oil and heated until they lose much of their brittleness. Then they are held over a spirit flame and bent as desired. The threaded ends of the stem are protected while bending by an arbor screwed therein.

The pipes are now carefully smoothed with pieces of American rush, or shave grass; the stem of the grass, owing to the natural deposit of silica, has a slight roughness which perfectly adapts it for this service. After the pipe stems have been properly finished with the rush, they are immersed in melted wax for a short time, depending on the density of the amber, and then they are given a high polish with precipitated chalk.

Amber Pipe Stems, Mending.—There are two methods for cementing amber. One method is to touch the broken ends with boiled linseed oil and warm over a gas flame, then bring the ends together and bind round with wire to hold the whole tightly in position. Allow to stand for a few days to set, remove the wire, rub the cemented part with a smooth file, and polish with a rag dipped in oil. The other method is to dissolve a little hard gum copal in ether to form a thick varnish, touch the broken parts with this, and quickly bind with wire; do not warm it, but allow to set for a few days.

Amber Pipe Stems, Testing.—Amber may be tested by warming it slightly. Genuine amber gives no odour when it is warmed, but the artificial material usually smells of camphor. If a small chip can be obtained and held in a flame, it melts and does not inflame very quickly, but artificial amber immediately burns very vigorously.

Briar-root Pipes.—The history of the briar-root industry is somewhat curious. First begun in the Pyrenees about the middle of the nineteenth century, it travelled along the French Riviera and the Ligurian coast to the Tuscan Maremma, taking Corsica by the way, and has reached Calabria in the south; this now is the most flourishing centre of the industry. Of course, when a district is exhausted of its roots, the industry cannot be carried on longer there, and it is supposed that the Italian branch can last only a few years more. Leghorn has been the centre of the export of Tuscan briar-root since the Maremma industry came into existence, but as the South Italian briar is of a superior quality, a large quantity of the Calabrian root is imported also into Leghorn for selection and subsequent export. The wood from which briar pipes are made is the root of the large heath known in botany as the *Erica arborea,* the word "briar" being a corruption of the French word "bruyère." All the root that comes into Leghorn has been cut already on the spot into the shape in which it is exported to the pipe-manufacturing centres, which are principally —at least as regards Italian briar—St. Claude in France, Nuremberg in Bavaria, and various towns in Rhenish Prussia and Thuringia. The roots, which sometimes are 2 ft. in circumference, are cut into blocks and then boiled. If blocks containing flaws are boiled they are sure to split sooner or later. Briar-root blocks are cut into about twenty-five different sizes and three principal shapes; these are "Marseillaise," "Relevé," and "Belgian." The first two are the more usual shapes; from the "Marseillaise" blocks are cut the ordinary briar pipes, which have the bowl and stem at right angles; "Relevé" blocks are cut into a shape for converting to hanging pipes; and "Belgian" blocks, for which there is but small demand, are shaped to form pipes having the bowl and stem at an obtuse angle. The minimum size of "Marseillaise" blocks is about 3 in. long, 2 in. deep, and 1½ in. wide.

Briar-root Pipes, Cementing.—A suitable cement may be made by placing a few pieces of gelatine in a small wide-mouth bottle, and covering with strong acetic acid; next day melt down by a gentle heat. Apply a little to each of the broken ends, press them together, allow to stand for a few days, and pare off the excess cement with a knife.

Briar-root Pipes, Polishing.—Briar-root pipes are ofttimes simply oil-polished—that is, wiped over with linseed oil, then subjected to friction by holding against revolving discs or a buff made of several layers of chamois leather. A steel burnisher is sometimes used. Ordinary french polish is unsuitable for pipes likely to get hot by smoking. One oz. of seed lac dissolved in 1 gill of methylated spirit and applied by a small piece of chamois will give a shine that can easily be renewed as required. A

trace of linseed oil applied at the same time as the solution will enable it to be spread more evenly.

Cementing Pipes.—For general pipe repairs there is nothing better than Canada balsam, which can be obtained from any chemist in a stiff honey-like mass; it should be placed in a tin, and baked in a moderately hot oven until it becomes hard when cold. The material should next be placed in a closed bottle, and treated with just sufficient benzene to cover it; it will then form a paste which is solid when cold, but fluid while warm. When the cement is required for use, place the bottle in cold water, and heat gradually until fluid; apply to the parts to be mended and warm them, then press together. The cement sets almost immediately, but will harden still further as the benzene evaporates. As Canada balsam melts when very hot, some pipes cannot be mended with it; in such cases, use a stick of shellac, which is melted and applied in the same manner as Canada balsam, but the parts will require more heat before they will adhere.

Clay Pipes.—Clay tobacco pipes are made from ball clay, which is found principally in Devon and Dorset. The first operation is to free the clay from all impurities by soaking it in large water tanks and stirring the solution so that any coarse particles or stones may be deposited at the bottom. The clayey solution is then poured off into another tank and allowed to remain till the clay has sunk and the water has become clear. The water is drawn off and the clay left till stiff enough for use. The prepared clay is spread on boards and well beaten, to mix and temper it and make it more plastic. It is now fit for use, and is divided into small pieces of sufficient size to make a pipe. These pieces are rolled by hand into the rough shape of a pipe, and laid aside for a day or two till sufficiently dry for moulding. The moulder takes the roll of clay and forms the bore by pushing a long needle (Fig. 560) through the centre of the stem, guiding it with the fingers of his left hand to ensure its being exactly in the centre. This operation requires considerable practice, for anyone unaccustomed to the work would very probably not push the needle more than an inch or so along the stem without piercing the sides. The roll of clay, still containing the needle, is then placed in the mould (Fig. 561), which consists of two pieces, each piece being impressed with the shape of one half of the pipe. The mould is next placed in a vice fixed to the bench, and the two pieces are firmly squeezed together. A piece of metal (Fig. 562), formed to the shape of the inside of the bowl, is pushed into the mould, and any excess of clay

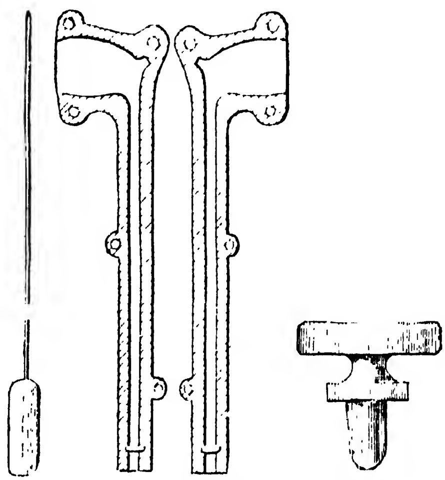


Fig. 560. Fig. 561. Fig. 562.

Fig. 560. Needle for Clay Pipe.
Fig. 561. Mould for Clay Pipe.
Fig. 562.—Template for Bowl of Clay Pipe.

that is squeezed out is cleaned off with a knife. The mould is now opened, the needle withdrawn, and the pipes are placed on a board, where they remain till they are in a fit condition to receive the finishing touches by cleaning off rough edges and irregularities, another needle being passed through the stem to see that it is quite clear. The pipes are next taken to the drying-room till perfectly dry and hard, the needle being left in the stem to prevent bending or warping during drying. They now are baked in small muffle kilns or in saggers. Saggers are simple earthenware boxes arranged in the kiln in such a manner that the flames may not come in contact with the pipes.

A muffle kiln is a kiln having an outside lining of firebricks built clear of the outer walls. The fireplace is at the bottom, and the smoke and heat pass up between the outer and inner walls, escaping at the top through a tall chimney. The duration of the firing may vary from five to eight hours. Before the saggers are removed and the pipes taken out, the kiln is allowed to cool for about twenty-four hours. In Fig. 561 the open metal mould is shown in two halves. On one half are five projecting knobs, and on the other half are a similar number of hollows into which the knobs fit so as to keep the two half moulds in place when fitted together.

Clay Pipes, Colouring.—The artificial colouring is applied by dipping the pipe in a solution of some organic matter, which is taken up by the pipe and is afterwards charred by the heat of the burning tobacco. Skimmed milk or a solution of sugar is suitable for this purpose. A pipe can be coloured without smoking by allowing it to soak in a warm solution of sugar for a few hours, then drying in an oven, subsequently soaking in strong sulphuric acid, washing in water, and again drying.

Cleaning Foul Pipe.—To clean a foul tobacco-pipe, fit into it a rubber stopper or a cork through which a hole has been bored large enough to receive the nozzle of a soda-water syphon; this should fit tightly. Press the syphon lever for a moment or so, and the passage of the liquid will force all impurities out of the pipe-stem.

Meerschaum Pipes. — Meerschaum is worked in the following way:—The large pieces of meerschaum are cut with a band saw to a convenient size, after which the material is soaked in water until it becomes quite soft. When wet it becomes very soapy, and will produce quite a lather if rubbed. In fact, the material serves as a very good substitute for soap, and is thus used in Morocco. After being thoroughly soaked, the meerschaum can be cut like cheese, and it is then roughly shaped with a knife to the form of a pipe. When dry, the bowl and stem shanks are drilled, and then if the pipe is of a plain pattern, it is turned on a lathe to the desired form. If a square stem shank is desired, it is shaped with a file. The shank is now shouldered and threaded to receive the amber stem-piece.

Meerschaum Pipes, Cementing.—(1) Just cover a small quantity of gelatine with strongest acetic acid, and allow to stand for a few hours, then melt it down by standing the bottle in hot water. Touch each of the broken parts of the pipe with the warm solution, and place aside for about half an hour to allow it to soak in; then moisten again with the solution and bind the two pieces together. After letting it stand over-night, scrape off the excess of cement with a penknife, rub over the joint gently with French chalk, and then place aside for a few days for the cement to become hard. (2) A cement for binding broken pieces of meerschaum may be obtained from garlic, made into a sort of dough, and rubbed over the surfaces to be joined. The latter should then be bound tightly together and boiled in milk for half an hour. (3) Reduce 5 parts of freshly-burnt plaster-of-Paris and 1 part of freshly-burnt lime to a powder, and, after mixing, moisten them with white of egg. This should be applied to the broken pieces, and then left to set for several days. (4) The following is suitable for filling up a hole: Take a little heavy magnesia, make into a paste with the smallest quantity of a strong solution of magnesium chloride, and fill in the hole as quickly as possible; it will soon set hard, and may then be polished over with a piece of white wax.

Meerschaum Pipes, Cleaning.—A very simple and effective way of cleaning the inside of a pipe is to plug up the bowl with a cork in which a hole has been bored. Fit the cork against the water tap and turn on the water. To clean the outside of the pipe, make a thick paste of whiting and turpentine, and brush it over with a hard brush. Leave the paste pretty thick on the pipe, and allow it to become quite dry, when it should be brushed off with a clean hard brush. Finish cleaning the pipe by rubbing over with a soft cloth and sweet oil.

Meerschaum Pipes, Colouring.—For colouring a meerschaum pipe, ordinarily it is boiled in a preparation of wax; this is

absorbed, a thin coating of it being held on the surface of the pipe and being made to take a high polish. Under the wax is retained the oil of tobacco, which is absorbed by the pipe, and its hue grows darker in proportion to the tobacco used. A meerschaum pipe at first should be smoked very slowly, and before a second bowlful is lighted the pipe should cool off. This is to keep the wax as far up the bowl as possible, for rapid smoking will overheat, driving off the wax and leaving the pipe dry and raw. A new pipe should never be smoked outdoors in extremely cold weather. Fill the pipe and smoke down about one-third, or to the height to which it is to be coloured. Leave the remainder of the tobacco in the pipe, and do not empty or disturb it for several weeks, or until the desired colour is obtained. When smoking, put fresh tobacco on the top and smoke to the same level. When once burnt, the pipe cannot be satisfactorily coloured, unless the burnt portion is removed and the surface again treated by the process by which meerschaum is prepared. The colouring is produced by the action of the smoke on the oils and wax, which are superficially on the exterior of the pipe, and are applied in the process of manufacture. The following method has been found successful:—The pipe is covered with chamois leather from about ¼ in. from the top of the bowl to the junction of the mouthpiece. This must be sewn tightly round the bowl and stem, care being taken to prevent scratching with the needle. The leather may be taken off when the colour begins to show on the outside of the pipe, but the longer it is kept on the better, as it saves the pipe from scratches. If desired, the pipe may be covered to the top of the bowl; but the above method shows the seasoning to better advantage.

Meerschaum Pipes, Imitation.—These are said to be prepared from a mixture of the artificially prepared silicates of magnesia, alumina, and lime, and sulphate of lime; these are mixed together in the state of pastes, dried at the ordinary temperature, cut into small blocks, and dried on a stove. The blocks are then turned in the lathe in a similar manner to real meerschaum. Imitation meerschaum pipes should not be varnished; the varnish will burn or crack when the pipes are smoked. They may be warmed and rubbed with a little white wax, and then polished with a soft rag. The best way, however, is to polish them with a revolving wooden polishing wheel covered with leather or felt, using dry putty-powder or whiting.

Meerschaum Pipes, Removing Discoloration from.—To clean the carving on a meerschaum pipe and remove the black around the top, wash the bowl with hot milk, using a tooth or nail brush to clean the dirt out of the carved portion. For the black part try the effect of very fine pumice-powder and benzoline; bring up the gloss again with putty-powder and a trace of olive oil. The greater part of the colouring of a meerschaum may be removed by steeping it for some time in moderately strong ammonia solution, 1 part of strong ammonia to 2 parts of water.

Meerschaum Pipes, Re-waxing.—Carefully clean the pipe by rubbing all over with soft rag wetted with methylated spirit and dipped in pumice-powder, finishing with clean, soft rag. To re-wax, place a small spirit lamp beneath the pipe, but near enough to the pipe to keep it sufficiently warm to melt a piece of white wax held against it. Let the wax touch those parts only which are intended to be coloured, and when the pipe is cold, wipe off the superfluous wax with a soft rag. Pipes can also be re-waxed by merely making them hot enough with smoking to melt the wax. Any colouring wrongly placed can be removed by dipping the bowl to the required depth in chloroform. Re-waxing demands care and patience. Another method is to cut 1 lb. of white Castile soap into thin shavings, boil with 2 pt. of water till dissolved, then add 1 lb. of white beeswax, also in thin shavings, and stir till cold. Well rub this paste into the meerschaum and polish with a silk rag. A harder polish can be obtained by using Carnauba wax in place of beeswax, but this is difficult to emulsify with the soap.

Meerschaum Pipes, Testing.—A simple test for meerschaum is to rub it with a piece of silver. If the meerschaum is

artificial, a lead-pencil-like mark will be left; on the genuine substance no mark will be made. Genuine meerschaum is readily scratched by the thumbnail, is soapy to the feel, and readily adheres to the tongue. The quality of true meerschaum is best determined by smoking it; a bad quality, being very porous, will soon become coloured, and will foul sooner than a good one.

Tools

The handyman's chief tools are described briefly under their respective names.

Preserving Tools.—The steel parts of tools may be coated with a mixture of white-lead and lard oil; this can be easily cleaned off when desired. Or perhaps a better plan will be to wrap the tools in paper that has been well soaked with lard or sweet oil. The wooden parts should be well rubbed with linseed oil, and then packed if possible in a box lined with oiled paper and placed in a dry position. Should the linseed oil dry into a kind of varnish, it may be removed by using a scraper or coarse and fine glasspaper, or by well covering the tools with turpentine and letting it soak in for a few hours, then removing by well rubbing with a rag. There are several ways of preserving steel tools. One method is to render in an oven some fresh mutton suet and cover the steel with it whilst hot. Another method is to rub over the bright parts of the tools a mixture of best lard and a little best olive oil, then dust over with lime. Best copal body varnish may also be used.

Torches

(1) For a skater's torch, say, 2 ft. 6 in. or 3 ft. long, take a piece of wood 2 ft. long, and plane it round and clean till it is about 2 in. in diameter. Plane off to a point, but not a sharp one—leave it $\frac{1}{2}$ in. in diameter. Divide this $\frac{1}{2}$ in. into three parts. Now saw off about 10 in. from this end, taking care to gauge it to a nicety, to ensure it standing upright when finished. Next make three straight lines from end to end, equally dividing the piece into three parts. Placing it in a vice, saw through each line to the centre. There are now three pieces. These must be attached to the part where first sawn off by three small hinges; these pieces will form three feet (see Fig. 563). To prevent these feet opening too far, hollow out the inside of them and screw a small

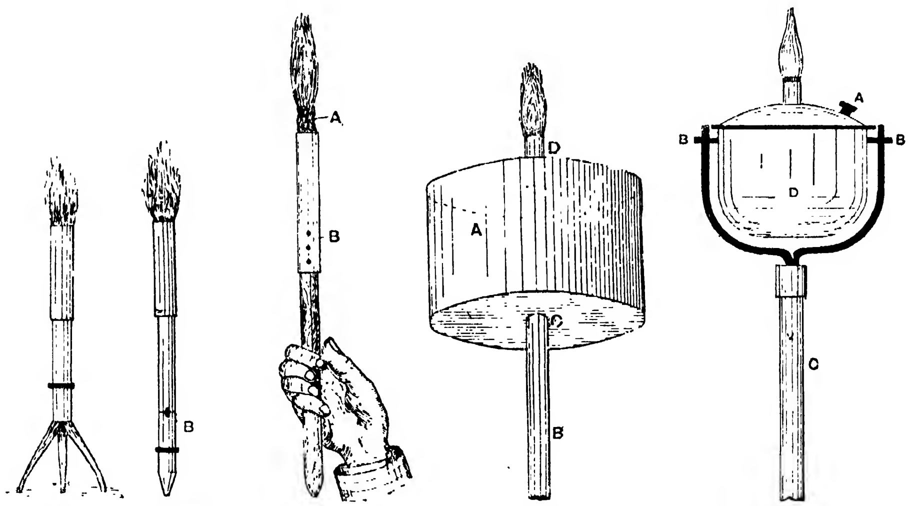


Fig. 563. Fig. 564. Fig. 565. Fig. 566. Fig. 567.

Figs. 563 to 567.—Four Kinds of Torches.

screw-eye in the hollow of each; attach a short piece of string to each eye, each piece joining in the centre. An india-rubber ring must be put round this foot to keep the three parts together (*see* B, Fig. 564). The torch may be stuck in the snow or any other handy place; the ground would be too hard. By slipping the india-rubber ring up the torch, and pressing the point on the ice, the three feet would open out, and the torch would stand upright on the ice (*see* Fig. 563), and so be useful when skating. The fire end of the torch must be made with sheet iron bent round and riveted; this might be about 1 ft. long, and must fit on the wood tightly. A piece of iron should be cut round, and fitted inside about 2 in. up the end of the tube which goes on the wood, forming a bottom to the tube. This will leave 9 in. or 10 in. for the combustibles when the tube is fitted; a couple of screws will keep it firmly fixed. For a good light, have a piece of old tar rope; separate the strands, and soak them in Stockholm tar, adding some paraffin oil. Bind up with wire. Make this large enough to fit the iron tube, leaving 3 in. or 4 in. out for lighting. Fig. 564 shows the torch complete, with feet closed; Fig. 563, the torch, with feet open, standing on the ice. (2) Fig. 565 shows another but similar kind of torch. Make the handle of wood, about 18 in. long; a piece of a broom handle answers well. Bend a piece of tin about 9 in. long, as shown at B, tightly round one end of the stick and nail it with 1-in. flat-head clouts. The tin should go on about 3 in., leaving 6 in. for the torch. Next obtain about a foot length of old tar rope twisted very close, bound round with wire, and make it fit the tin socket, leaving about 6 in. for the burning part, as shown at A. Now get 1 qt. of coal-tar and 1 pt. of paraffin oil, mix the two together, and lay the rope in this to soak, turning it about occasionally for a day or two. When thoroughly soaked, take it out and hang it in the air to dry. When dry, place it firmly in the socket and light the end. (3) Fig. 566 shows a torch which has many advantages. It burns paraffin, is safe and cleanly to use, and burns a long time. The oil holder A is a tin-plate cylinder holding about half a pint; a mop handle B is fastened to a socket C in the bottom, and a thick cotton wick fits the opening D in the cover. It may be carried over the shoulder in a slanting position, or upright in the bearer's right hand. These torches may be made at a cost of about sixpence each. (4) A superior

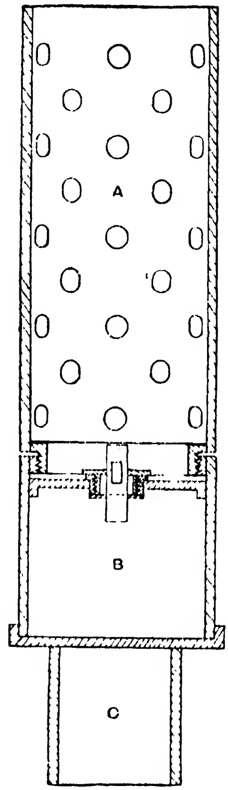


Fig. 568.—Lamplighter's Torch.

kind of torch is shown by Fig. 567. If the torch last described were carried slanting on the shoulder, the bearers, or other persons, would be in danger of having their clothes spoiled by the oil running out when the torch is full. The object of the torch shown by Fig. 567 is to avoid this. A (Fig. 567) is a screw-cap for refilling with paraffin. The vessel has a short spindle fixed on each side (B); the handle C (a mopstick with ferrule will suit admirably) is fitted with a bow of $\frac{3}{8}$-in. round iron, with

a hole at the two extremities, through which the spindles B are placed, and a shank at the bottom is driven into the mopstick (*see* dotted lines). In whatever position the handle may be, the vessel D will always retain a vertical position, and no danger will result.

Lamplighter's Torch.—A lamplighter's torch is shown by Fig. 568, in which A is a brass barrel perforated, B is a cylinder of the same diameter, with a metal disc edged up and soldered to the bottom. A second disc, which carries an ordinary circular-wick lamp burner, is soldered inside the cylinder about three-eighths from the top, the space between the two discs forming the oil reservoir. A threaded socket and collar are soldered to the cylinders, as shown, so that the cylinder A can be removed when filling the reservoir or when lighting the lamp. When in use, the lamp is lit and A screwed on securely; the perforated barrel is then inserted in the gas lamp, and the gas percolates through the holes in the barrel until it reaches the flame, when ignition occurs. C is a round brass socket in which the pole for carrying the torch is inserted.

Tortoiseshell

Panama tortoiseshell comes from the hawk's-bill turtle, or imbricated turtle, which is found only in the Gulf of Mexico and Caribbean Sea. This turtle is recognised by the low, wide head, a long, narrow mouth, the upper jaw prolonged, and hooked like the beak of a hawk. The shell is flattened and serrated behind, with five vertebral and eight lateral plates overlapping one another like scales of a fish. The colour is yellowish above, mottled with chestnut brown, and yellowish white below. Young turtles have a black spot on the four rear pairs of plates. Old turtles have a thin yellow plate on the belly, which is much sought after, and commands a higher price. This hawk's-bill turtle feeds on seaweed, crabs, etc. According to the American Consul at Colon, the shells shipped from his district are taken from turtles caught on the Lagarto and San Blas coasts of the Caribbean Sea between May and August, when they approach the shore to deposit eggs, which are laid on the sandy beaches above high-water mark at night. Holes are dug about 1½ ft. deep, and the eggs deposited therein; generally about three layings are made during a period of nine weeks. The eggs are lightly covered with sand, and left to be hatched out by the heat of the sun. The turtles are caught either while on shore or in the water by means of nets. As a rule, they are killed immediately after being caught; then they are cleaned, and the shell-frame washed with sand. On the San Blas coast, however, the Indians do not kill them, but at once proceed to remove the shell by subjecting the turtles to great heat, afterwards throwing the turtles back into the sea. By the application of heat the successive plates of shell come off very easily. Turtles caught in these waters vary in size from 1 ft. to 4½ ft. long, with a maximum weight of 150 lb., and the average weight of shell obtained from each is 6 lb. to 7 lb. The commercial value of tortoiseshell depends on the thickness and size of the plates rather than on the brilliancy of the colours. The price of shell in the Panama market fluctuates from 12s. 6d. to 25s. per pound.

Cement for Tortoiseshell.—(1) A very efficient cement for uniting tortoiseshell and similar articles can be made by covering gelatine with strong acetic acid, and, after standing overnight, melting down by gentle heat. (2) Obtain a small quantity of Canada balsam, and bake it in a vessel in the oven until it is quite hard when cold. Now melt it, and in it dip the parts of the work to be joined, and bind them with wire until the next day; then remove the wire and shave off the excess of balsam with a sharp penknife. (3) Dissolve in 125 parts of 90 per cent. alcohol, 30 parts of shellac and 10 parts of mastic, and add 2 parts of turpentine. (4) Dissolve in 58 parts of 90 per cent. spirit of wine, 5 parts of mastic and 15 parts of shellac, and add 1 part of turpentine.

Combs.—In making tortoiseshell combs, two are cut out of one strip, and, while soft, a deep zig-zag cut is made down the centre of the strip to form the teeth of the two combs, which thus fit closely to each other. As quickly as possible the two parts thus

divided are torn asunder, as in a few seconds they would reunite. This is a difficult operation, and liable to prove costly if much waste results. To form the knobs and other raised parts seen on fancy tortoiseshell combs, the shell is heated, and while in a pliable state is gradually worked and pressed up into a mould of the required form, and subsequently smoothed and polished. Material which has been thus treated cannot be re-shaped if broken, for on re-heating it takes its original form, from which it cannot be altered. Combs are usually made of more than one thickness of shell, and as many as six thicknesses are sometimes welded together. When patterns are to be carved into the work, extra thicknesses are welded on. Shell from the claws is used when a streak of unusually light colouring is required, and the under or "belly" shell, which is almost transparent, is used for the amber shell-work.

Combs, Reviving.—To revive tortoiseshell combs, which often get dull and dingy-looking, dip the finger in linseed oil and rub over the whole surface of the comb. Use but very little oil. If there is a pattern on the comb, it may be necessary to use a soft brush to get it into the crevices. Then rub with the palm of the hand until all oil has disappeared, when the shell feels hot and looks bright and shiny. A very dull comb will need a good deal of rubbing.

Cutting Tortoiseshell.—Tortoiseshell may be roughly cut to shape with a fine fretsaw, and trimmed with a fine file or with a sharp knife or graver. Any carving upon it should be done with gravers similar to those used by metal engravers, the cuts being made very shallow owing to the thinness of the material. The original rough surface may be removed with powdered pumice-stone and water, and the polishing should be done with dry rouge on a soft rag, the final polish being obtained by rubbing with a soft cloth or velvet pad.

Polishing Tortoiseshell.—The process of polishing depends on whether the entire carapace (shell) or detached plates are to be treated. Too vigorous methods should not be employed in the former instance, or disconnection of the plates from the skeleton will result. General instructions are therefore given as follow. First well wash the shell in warm water and soap powder, and subsequently further cleanse it by means of dilute sulphuric acid, $\frac{1}{2}$ oz. to 1 pt. of water, removing all traces afterwards by washing. Then proceed to reduce the corrugated surface of each plate by means of the edges of broken glass and coarse, medium, and fine glasspaper, until a perfectly smooth surface is obtained. Powdered pumice should next be rubbed on by means of a soft cloth, and polishing can then be proceeded with. The material used is stannous oxide (putty-powder) moistened to a thick paste with lard oil. This is applied continuously with a soft cloth, until a polish begins to appear, when the oil may be omitted, and the dry powder used alone until a brilliant polish is obtained. In the final stages, the palm of the hand should be used instead of the cloth, slightly moistening the work by breathing on it.

Tortoiseshell Snuff-box.—For making a tortoiseshell snuff-box, the tortoiseshell should be boiled with water and then pared down to the requisite thickness with a large sharp knife. Having cut out a piece of tortoiseshell large enough for the box, put it in a press with a hot die and force it into the depression with considerable pressure. The pressure is kept up until the press cools, when the box is turned out and will keep its shape. A lid being cut to fit, the box and lid are polished on the outside with putty-powder or whiting and water. The hinge should be of thin sheet brass long enough to go the whole length of the lid. Holes for the rivets are made with an Archimedean or bow drill, and the hinge is secured to the box and lid with tiny rivets made from softened brass wire.

Welding Tortoiseshell.—The edges to be united are shaved and scraped to a feather edge, and laid together with a piece of fresh shell upon them; the whole is next subjected to a moist heat (as of hot water), which softens it, and it is then put under great pressure until the parts are united, after which the surplus thickness is removed as waste. Another method of welding tortoiseshell is first to file it clean, and lap one edge over the other, taking care that no grease remains; wet the joint with

water, and hold it in a hot pair of pincers, so constructed as to cover 4 in. or 5 in. of the joint. Remove the pincers and apply more water, and the joint will be found secure. The pincers must not be so hot as to burn the shell.

Tracing Cloth and Paper

Tracing Cloth.—(1) Moisten fine linen cloth with benzine and then apply a flowing coat of a varnish made by boiling together for several hours 5 lb. of bleached boiled linseed oil, 4 oz. of lead shavings, 20 oz. of zinc oxide, and 4 oz. of Venetian turpentine; strain and add 20 oz. of white gum copal. When this is all dissolved, remove from the fire, and when partly cold bring the mass to the proper consistency for applying by adding purified oil of turpentine. (2) Varnish fine linen with a solution of Canada balsam in turpentine to which has been added just a few drops of castor oil. Experiment on odd pieces of linen first.

Tracing Cloth, Restoring Surface of.—Collodion for restoring the surface of tracing cloth will be found very useful after considerable erasing. After the ink has been scratched off the cloth in making an alteration a poor surface is left for the new ink lines. The place round the erasure must be perfectly clean, and it is best to apply the collodion with a small camel-hair brush, and then let it dry. If not properly dry, the ink will make a big blot. Large spaces can be prepared in this way, and the re-tracing, even with heavy lines, will be found quite satisfactory. After using the collodion, cork the bottle well to prevent evaporation.

Tracing Paper.—(1) Tracing paper can be made from ordinary paper by dipping in benzene; the benzene evaporates quickly, when the paper will again be opaque. (2) Dipping the paper in a solution of glycerine and drying between two pieces of clean blotting paper will render it transparent until it is dipped in water, when the glycerine will dissolve out, and, on drying, the paper will return to its original opaque condition. (3) Writing paper treated with paraffin oil makes a good tracing paper. (4) Another method, and perhaps the best, is to brush or sponge tissue paper with a mixture of 1 part of boiled linseed oil and 5 parts of turpentine. In this, and all the above methods, the paper must be dried on a line. When the clear oily marks disappear the paper will be ready. (5) Dilute castor oil with from 1 to 3 times its bulk of absolute alcohol and sponge this on the paper, which will be ready when the alcohol has evaporated. The oil can be completely removed from the paper with alcohol.

Traps (*see* Beetle, Mouse, etc.)

Tubes (*see also* Pipes)

Bending Brass Curtain Poles.—The following shows how to straighten two brass curtain poles that have been used for a bay window. First anneal the tube where bent, then load it with lead, and, after cooling, pass it through a hole in a firmly fixed bench until the shoulder of the bend rests against the shoulder of the hole. Then pull the tube against the wood shoulder until it is quite straight. Finally, melt out the lead and repolish the tubes. Straight brass curtain poles can be bent to any easy curve in the same way.

Bending Copper Tubes.—The best way to bend $\frac{5}{8}$-in. pipe, made of copper $\frac{3}{32}$ in. thick, into a spiral 3 in. internal diameter will be to fill the tube with melted resin and wind round a post or mandrel 3 in. in diameter, then melt the resin out. A 1-in. tube could be loaded with resin or melted lead, and then bent by means of a hole cut through a deal or other soft wood plank. Brass tube can be bent the same as copper. Such tubes should be bent cold.

Bending Kettle Spouts.—In bending tin and copper tube for kettle spouts, the usual practice is to load the tube. If the material used is ductile, it may be possible to bend it satisfactorily by inserting a piece of cane of the same diameter as the inside of the tube, and then bending the spout upon a trammel of suitable shape, afterwards withdrawing the cane.

Speaking Tubes (*see* main heading, Speaking Tubes).

Turpentine

This is an oleo-resin obtained in the form of a more or less slimy gum (gum

thus) by making incisions in the trunks of certain pines, firs, spruces and other members of the great group Coniferæ, and a few species of the genus Pistacia. The gum is melted, and as it becomes hotter and hotter, tepid water is made to flow over it. The water that runs over settles in vessels, and the pure turpentine is run off into barrels ready for use. Crude turpentine is the gum direct from the tree. Oil of turpentine, spirit of turpentine, and ordinary or common turpentine are all the same thing; it is quite a different substance from an ordinary oil such as olive oil, which does not "dry" when exposed to the atmosphere. Fat oil of turpentine is turpentine that has been thickened by oxidation, it having been exposed to the air for some time.

Heating Turpentine. — There are two methods of heating turpentine without danger. When an open pan is required, this is made with a jacket—that is, there are two pans, an outer and an inner one, with a space between; superheated steam from a boiler is passed into the space, and is allowed to escape through a waste steam valve at the bottom; a safety valve at the side of the pan allows the steam to blow off if the temperature rises too high. Turpentine boils vigorously at a temperature of about 170° C. (338° F.)—much higher than the boiling point of water—hence steam at ordinary pressure would not cause turpentine to boil. Turpentine can be heated to boiling point over a burner or fire, provided it is contained in a still which is closed with the exception of one tube leading to a condensing coil, kept cool by being placed in a tub, through which a current of cold water is caused to flow. Any turpentine which may be vaporised is condensed in the worm and recovered, and no vapour can pass into the outer air.

Testing Turpentine.—To test turpentine for purity, place a drop of the suspected liquid on a clean piece of white paper. If the paper assumes its original appearance within five or six minutes, the turpentine may be considered pure. If there is a grease spot that will not disappear in ten or fifteen minutes, the presence of mineral oils is evident. There are many other methods.

Venice Turpentine.—This is a crude turpentine, and is a common name for the honey-like mass direct from the tree, otherwise known as gum thus, although it is not a true gum, as it is not soluble in water. True Venice turpentine comes from holes made in the bases of larch trees.

Venice Turpentine to Dry Hard. Place it in a dish and heat in a slow oven for a few hours; on cooling, it will dry quite hard. Dry Venice turpentine produced in this way may be broken up and dissolved in spirit of turpentine; it will then form a varnish that will dry like any other varnish, but the film will be extremely brittle.

Twine

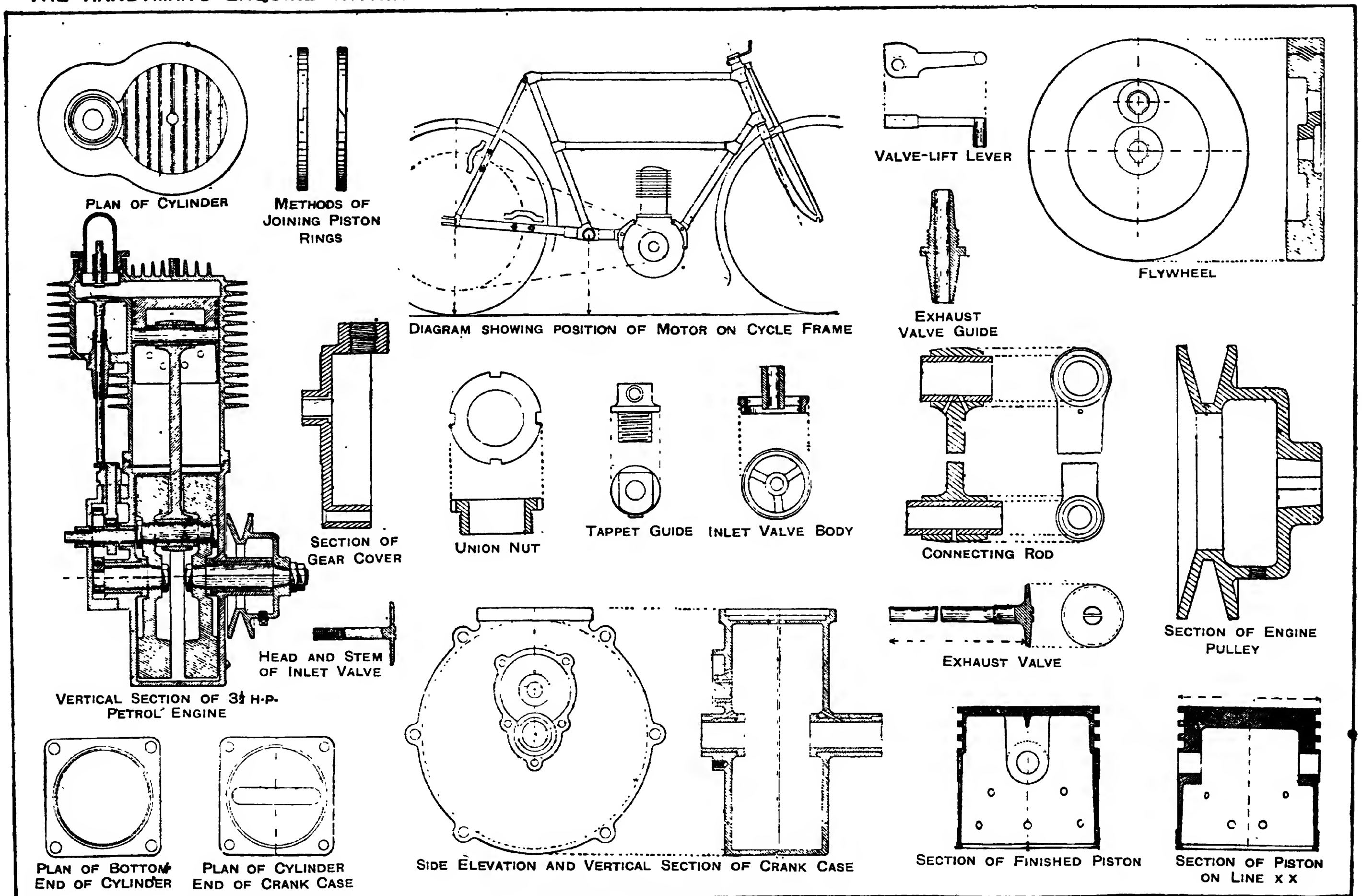
The length of twine in a ball can be determined, it is said, by the following simple rule:—Take a ball, press the strands close together, and note the number required lying side by side to make an inch. The number of strands will represent so many lengths of 50 ft. to every pound the ball weighs; the less the number of strands, the less the number of feet required to weigh a pound. If ten strands lying side by side make 1 in., then a pound will contain 500 ft.; if eleven strands, 550 ft.; if twelve strands, 600 ft.; and so on. To work the rule, all that is necessary is first to measure, and then to weigh.

Tyres (*see* Cycle *and* Mailcart)

U

Umbrella Making, Renovating and Repairing

Most of the tools required for umbrella making will be in the box of every handyman, and the remainder will not cost much to buy. A saw will be wanted for shortening sticks, etc.; cutting nippers for cutting wire; pliers for bending wire; a steel punch for fastening caps and ferrules and knocking out rivets (this tool can be made from a shoemaker's peg awl); pricking pliers for fastening caps and ferrules, but these tools may be dispensed with; nicking file for filing slots in notches and runners; round file for filing inside of notches and runners; hammer; rasp; file; and vice. A pad saw will be found useful to cut the spring slots unless the worker has a lathe fitted with a circular saw. An Archimedean drill, a rule, or yard measure, and engravers' scorpers for clearing the spring slots after sawing, will complete the outfit. The component parts of an umbrella are: Stick, two springs, runner, notch, eight ribs (called a set of ribs), eight mufflles, inside cap, cover and band, rosette, outside cap (brass), ferrule, and some soft and hard wire. Having selected a stick, the first thing in making an umbrella is to cut the spring slots. If it is a lady's umbrella, measure 10½ in. from end of handle and make a mark; from that mark measure 14 in. towards the point of stick, making a second mark a little to the right of the first mark. Fig. 569 will show how to place the slots. In cutting these slots, the stick should be turned a quarter of a revolution after one is cut and before starting the other, so as not to get the slots in a line with one another. In Fig. 569 the top portion of the stick has been turned round so as to show the top spring in side elevation. The length of a spring is 2¾ in. Now measure off 3 in. from the top mark towards the handle, then measure off 3 in. from the bottom mark towards the top mark. This shows the extent of the spring slots. The slot for the bottom spring is cut deeper towards the handle, and the top slot deeper towards the point. This is clearly shown in Fig. 570, which is a section showing the bottom spring in the slot. Now put the stick in the vice, and with the pad saw (about 4 in. set) commence to saw straight between the 3-in. marks, and try the spring to see that it will fit flush with the stick. Having cut the spring slots, next begin to make the springs. These are made from a piece of wire 3½ in. long, turned with a pair of pliers to the shape shown in Fig. 570 for bottom spring, and Fig. 571 for top spring. Give a sharp blow on something flat to the part marked B in Figs. 570 and 571; the blow will flatten the wire and cause it to hold in the stick more firmly. Take a fine bradawl and prick a hole in the spring slot as at A in Figs. 569 and 570; then take a spring and put the part marked B (Fig. 570) in the hole and give it a sharp blow with a hammer. Be careful to put the right spring in its proper place. Having placed the springs in, take a fine awl (a shoemaker's stabbing awl will do) and make a hole at C for the pin D (*see* Fig. 570). Next take two ordinary pins, cut them in half, take the pointed part and put into the holes thus made, and press in with the pliers; then cut off fair with the stick. In a gentleman's stick,



PETROL MOTOR FOR CYCLE

the distance from end of handle to bottom spring should be 8 in. to 8½ in.; between springs, about 16 in. Next comes the runner (Fig. 572); see that it is only just full enough to work up and down without any excess of play. Then get a notch (Fig. 573). This little item plays an important part in the whole, for unless it is fitted to the stick very snugly and firmly a rickety umbrella will be the result. It is better to get one that is a little tight, as it can always be eased with the round file. The ribs are made round and fluted; the round are known as solids, and the fluted as paragons. Then there is the "lock rib," which is similar to the paragon except that the stays (or short ribs) are a little wider. Ribs are made in different lengths; the usual sizes for ladies' are 21 in., 21½ in., 22 in., and 23 in.; gentlemen's, 24½ in., 25 in., and 26 in. There are also shorter ones made for sunshades, and longer ones for carriage umbrellas. Drill two holes in the notch as shown at E (Fig. 573). After the holes are drilled, run the round file up and down inside to take off the rough edge caused by drilling. Then commence to fill in the notch with the ribs. Let the stays (or short ribs) be inwards to the stick. In the notch will be found a small nick; commence to fill in on one side of this nick, finishing at the other side, using a piece of soft wire to thread the ribs on, and as each rib is threaded, press it firmly in its place in the notch. When the ribs are threaded, twist the two ends of the wire together and turn the point downwards. Next fill in the runner with the stays in the same manner, only in this case turn the point of the wire upwards. Now bring the runner in its place with the bottom spring through the slot in the runner. Put a fine bradawl through a hole of the notch and into the stick. Then open the frame, and, if all is right, put the bradawl through the stick and out at the other hole in the notch, then put a piece of hard wire in the hole just made and turn the ends. Some prefer to rivet the ends, but when they are turned the wire can be taken out more quickly for repairs. Next, open the umbrella with the runner resting in its place on the top spring. Now make two holes about ⅜ in. above the runner, turn a bit of wire like a small staple, and drive in the holes. This is called the stop wire; its purpose is to prevent the user from opening the umbrella too far. Next, eight muffles will be required; these can be cut from any black material about 1½ in. long and 1¼ in. wide; round off the corners, and then sew them over the joints in the ribs. These are called the middles. Now comes the cover. This

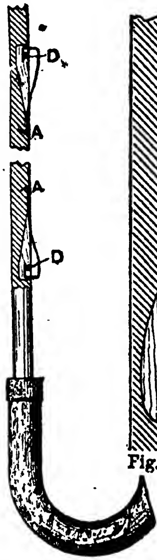


Fig. 569.

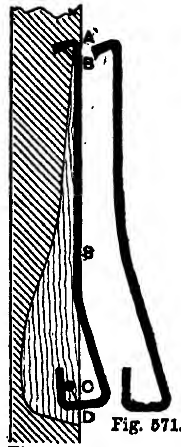


Fig. 570

Fig. 571.

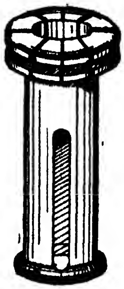


Fig. 572.

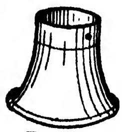


Fig. 574.

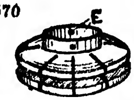


Fig. 573.

Fig. 569.—Umbrella Stick. Fig. 570.—Bottom Spring in Slot. Fig. 571.—Top Spring. Fig. 572.—Runner of Umbrella. Fig. 573.—Notch of Umbrella. Fig. 574.—Cap of Umbrella.

had better be bought ready made, for these reasons: it is cheaper than to buy the cloth to make one or two; also the bought cover will be a better cut than a beginner would obtain at the first or second attempt. There are many different kinds of material used for covers. The names of the best only will be given, and it should be remembered in making umbrellas that the best is the cheapest. The maker cannot do better than select from such materials as the "glorias," "Levantines," and "silks"; these are all made in different qualities.

When sending to the manufacturer for covers, state the kind of material wanted, with the exact length of ribs used in the frames, measuring from end to end of ribs. When the cover is received it will be found to be shorter than the ribs; this is as it should be. To put the cover on, first put on an inside cap; this can be made from any piece of black material cut round, with a hole in the centre; put over the end of the stick and press up close to the tops of the ribs. Turn the cover inside out and put the end of the stick through the hole in the top of the cover, then sew or bind the latter firmly to the stick. Now see that the cover is not in any way twisted, then take hold of one of the seams and pull it gently towards the tips of the ribs, and sew the cover firmly to the tips. The stitches are to go through the eye of the ribs and round outside. Having sewn the cover to the tips of the ribs, open the umbrella and pull the ribs into place (that is in line with the seams), and sew each rib in two or three places to the seam. While the umbrella is open, press inside with a hot iron. If the cover does not fit correctly, it may be rectified by removing the stop wire and moving the top spring higher up or lower down the stick. Sew a rosette round the runner, also one around the top of the umbrella, and put the cap (Fig. 574) over the end of the stick and press firmly on to the rosette, fastening it with a pin or rivet. Cut the point of the stick to any length desired; a good average length is 3½ in. from top of cap. Rasp or file the point to fit the ferrule, and fasten the ferrule in the same manner as the cap. If there was no band supplied with the cover, one must be made and put on; a piece of elastic and a button will serve very well for this purpose. The umbrella will then be complete.

Cement for Umbrella Handles.—Melt 4 parts of shellac and stir in 1 part of Venice turpentine; this cement must be melted before being applied. Cement made by dissolving glue in acetic acid would also be suitable; it is one of the strongest cements known, and will adhere to almost anything. If any exudes, wipe off with a cloth damped with hot water.

Cementing Silver Caps, etc., on Umbrella Sticks.—Ivory and bone handles are always fixed with a steel screw to the neck of the stick. As a cement for filling silver collars and caps, etc., the following will be found to give good results: melt slowly together 1 lb. of bottle wax and ½ lb. of resin, and thoroughly stir. Melt a little of this mixture in a tin, pour whilst hot into the cap, and insert the end of the stick. Do not force the stick in, or the cap will burst, and probably the hands and face will be burnt. Most umbrella dealers sell the wax cement. Collars are often bedded on with plaster-of-Paris, but this should never be used for putting on caps.

Cover Making.—First make the pattern by which to cut out the sections or gores. This may be of strong paper, but for permanent use sheet zinc is best. Cut neatly a square of paper, each edge of which is exactly the same length as the frame on which the cover is to be placed—that is, a 25-in. frame would take a square of paper with edges 25 in. long. Cut this across from one corner to the opposite corner to produce a piece shaped like A B C in Fig. 575. Measure from A towards C the same distance as from A to B (in this case 25 in.), and then cut along the line D B. The part A D B now forms the complete pattern. By measuring down the centre as shown by dotted line, the width of cloth necessary to cut the cover will be discovered. For 25-in. covers, cloth 22 in. wide is required. Always place the edges B D towards the selvedge edges of the cloth being cut, and allow a margin for hemming and sewing together. Sew the top of the cover with strong thread after machining.

Covers, Cleaning and Reviving.—It is rather difficult entirely to remove mud-stains. The best plan is to open the umbrella and try to wash the stains off with plenty of clear water (soft water, if possible). Also try washing the umbrella with soft water and a little ammonia. Experiment first on a portion of the cover. Ammonia is liable to alter slightly the shade of the cloth in some instances. Probably it would be cheaper to buy a new cover. If in good condition, the cover could be dyed. Umbrellas should be en-

closed in a case when not in use. Grease spots can be removed with benzene.

Covers, Cutting Down, to Fit Small Frame.—If the frame to be fitted is a 23-in., take, say, a 25-in. old cover, and cut off 1⅞ in. from the hem, following the curve in the gore; this allows the old "stretch" to remain. Having done this all round, re-hem the cover. If the cover is much worn on the top, cut all the gores out and lay them quite evenly one on the other; then place the pattern on them, and with a sharp knife cut down to B (*see* diagram, Fig. 576). It will be seen from Fig. 576 that the old stretch is below the bottom edge of the pattern. In the diagram, C C represents the old cover and P the pattern. After the gores are cut, take two and seam them together, and so go on adding a gore until all are in. Proper patterns for cutting covers to different sizes are cut from stout zinc.

Covers, Patching.—(1) Use strong, thick indiarubber solution. The patches can be cut from old umbrella covers, and should be either round or oval. Rub the solution on with the finger tip; also put a little round the edge of the hole if it is large. Large holes are best darned or sewn together. Of course, the patches are put on inside. Leave the cover open to dry. (2) Obtain from the chemist some black court plaster, which is silk covered with an adhesive. Moisten the adhesive with water, and affix over the hole on the outside of the umbrella cover. This makes a very neat patch, but the repair is not likely to last long.

Covers, Putting on New.—Prize up the brad in brass ferrule F (Fig. 577) with a small bradawl; slide it off, put the new cover on, stitch first to the steel ribs near the handle B^1 (Fig. 577); replace the ferrule, fasten it with a brad, open the umbrella, and stitch the seams of the cover inside the umbrella to the steel ribs at B^2 and B^3.

Cutting Umbrella Wires.—Probably the best way is to use a pair of Hall's (large size) American compound cutting nippers, which can be obtained from most tool-shops. Place the two edges of the wire against one side of the jaws, and the back or rounded part on the other side of the jaws, then put on the pressure. Do not cut side-ways, as this is apt to flatten the wire. The wire should be of good temper or quality, for if of the kind used in cheap umbrellas, it will fly like glass directly pressure is applied.

Dyeing Old Umbrella Covers Black.—(*a*) Boil 10 lb. of logwood in 2 gal. of water; strain, and make liquid up to 2 gal. (*b*) Dissolve 2 lb. of copperas and ¼ lb. of blue vitriol in 2 gal. of water. Heat (*b*) gently, then place the goods in, leaving plenty of room to move them about with a stick; bring to the boil, remove, and wring out. Next place in (*a*), heat to the boil, remove, wring out, and wash in soft water. Try with a small piece of the cloth first.

Fitting Silver Band on Umbrella Handle.—Bed the mount in plaster-of-Paris. If

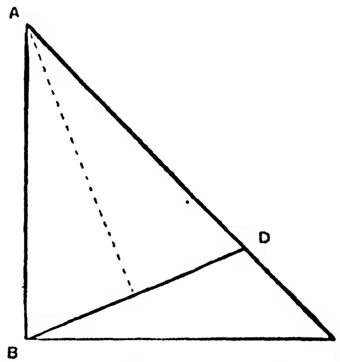


Fig. 575.—**Pattern for Umbrella Cover.**

the stick is rough and knotty, use a "pin-round" band; but if the stick is smooth and taper, use a slip-on collar. If pinned round, cut the overlapping edge to an obtuse vee, thus

Polishing Umbrella Handles.—If the handles are badly scratched and marked, first rub down with very fine glasspaper. Suitable buffs for use on the lathe can be purchased, or they can be made as follows:—Cut from calico sufficient circles (6 in. to 8 in. in diameter) to make a pile about 1 in. thick when placed on top of one another. Cut two discs (2 in. in diameter) of sole leather, place one disc on each side in the centre of the calico, and rivet right through with 3-in. or 4-in. French nails. Centre this on the lathe and revolve swiftly; hold a

pencil at the side and trim down to this mark. Apply to the edge of the buff a mixture either of powdered and sifted rottenstone or tripoli and mutton fat. Polish the handles finally with a plain buff.

Polishing Mounts.—A mixture of mutton fat and fine whiting can be first used; the wire the arms (stretchers) of the ribs from the runner, and turn the entire frame inside out. Unwire the ribs from the notch and re-wire them again, putting the new rib in place of the broken one. Turn the frame back again, and re-wire to the runner; then put on an outside cap. Take care

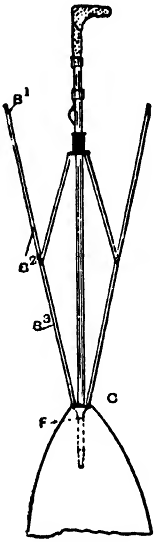


Fig. 577.

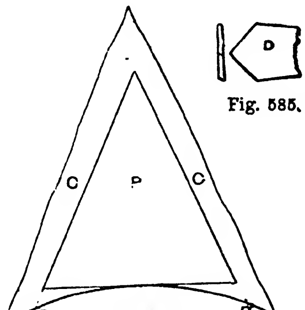


Fig. 576.

Fig. 585.

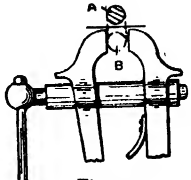


Fig. 580.

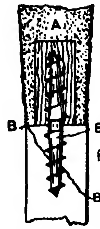


Fig. 578.

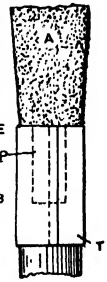


Fig. 579.

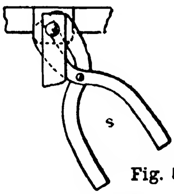


Fig. 582.

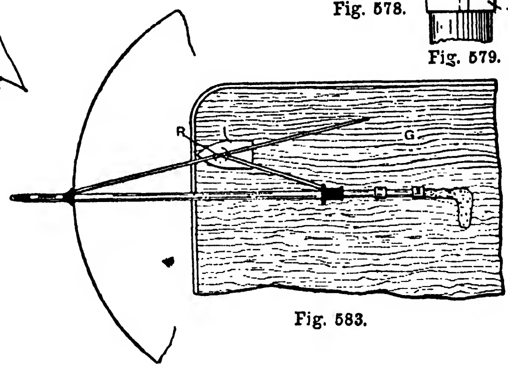


Fig. 583.

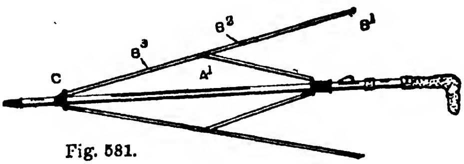


Fig. 581.

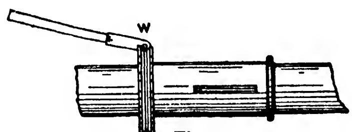


Fig. 584.

Fig. 576.—Re-cutting Umbrella Cover. Fig. 577.—Putting on New Umbrella Cover. Figs. 578 and 579.—Repairing Broken Stick or Handle. Fig. 580.—Forming Tin-plate Tube. Fig. 581.—Replacing Rib. Fig. 582.—Cutting Rivet with Snips. Fig. 583.—Umbrella in Position for Replacing Rib. Fig. 584.—Untwisting Wire holding Rib in Place. Fig. 585.—Point of Drill Bit.

polishing can then be finished with a mixture of mutton fat and rouge, and finally on a dry buff. Equal results can be obtained with a jeweller's polishing brush and rouge. Monkey Brand soap is also first-rate for old and badly tarnished mounts.

Putting New Rib in Umbrella.—First remove the metal outside cap. Then unthat both the new rib and stretcher are the exact lengths of the other ribs in the umbrella, or it will not close and open properly.

Removing Caps and Notches from Umbrellas.—The notch is nearly always fixed by a rivet passed right through the stick and the two sides of the notch. To remove the notch, file one head of the rivet flat and

punch out. Should the flange of the notch be inside the umbrella, it is best first to unwire the runner, turn the frame inside out, unwire the notch and, when re-wiring the notch, to put it in position (that is, with the flange towards the ferrule end of the stick). Sometimes the cap is fixed on with $\frac{1}{4}$-in. pins; these can be easily extracted with a pair of fine pincers. If the cap is very difficult to remove it is best to break it off and put on a new one, and thus save the possibility of injuring the stick.

Repairing Broken Sticks and Handles.—(1) Suppose that a handle is broken along the line B B (Fig. 578), A being handle of bone, plugged with wood, screwed on to other part of umbrella stick, as shown by screw E. Measure diameter of stick at B, multiply diameter by $\frac{22}{7}$, to get circumference of stick, and add $\frac{1}{8}$ in., to allow for joint of a tube (made out of a piece of sheet tin about $1\frac{1}{2}$ in. or 2 in. long, as in Fig. 579). This tube T is made thus: Umbrella stick is $\frac{1}{2} \times \frac{22}{7} = \frac{22}{14} = 1\frac{1}{7}$ in. circumference. Add $\frac{1}{8}$ in. for joint; the tin will then be about $1\frac{3}{4}$ in. by $1\frac{1}{2}$ in. Open the jaws of a small vice to allow of a piece of round iron or umbrella stick, $\frac{1}{2}$ in. in diameter, to pass through freely. Lay the tin to be bent into a tube across the vice, and hammer the round iron placed across top of tin into jaws of vice (Fig. 580); the iron, being hammered from A to B, bends tin to U shape, as shown. Tighten the vice, then hammer the edges of the tin round to form a tube, and solder along joint. Drive this tube tightly on the umbrella stick with a wooden mallet, hammer the plug P in the screw-hole, coated with good hot glue, bore a hole for the screw with a bradawl, and screw on the upper part A. Having a box of oil paints, paint this tin to resemble stick as nearly as possible. The paint can be mixed with picture mastic varnish. (2) When a stick is broken in the handle, use a brace and shell bit for boring out the waste wood. To prevent the stick splitting, bind it for a couple of inches with a wax-end, in a similar manner to the binding on the handle of a cricket bat or the rings of a fishing rod. After the new stick has been put in and the glue is dry, the binding may be removed. Treat the sticks before joining in a similar manner, and bore the holes with the brace and bit. Practice is necessary to bore the holes straight; but it will be of some assistance to tie on four straight sticks, to project about 3 in. or 4 in. beyond the end where the hole is being bored, to form a guide for the bit.

Repairing Umbrella Tube.—When a steel umbrella tube is broken at the notch, the better plan is to fit a new tube entirely. This saves time and is more satisfactory. However, to repair, remove the tube from the frame, then get a piece of round iron rod about 3 in. long and of such a diameter as will tightly fit the inside of the tube. If the tube is a thick one, possibly a piece of an old thin tube may be procured that will fit. Push about $1\frac{1}{2}$ in. of this dowel piece inside the tube and put a fine rivet right through, then fix on the end piece in the same way. The notch will best be refixed by hard soldering, as drilling a hole in the tube will weaken it.

Replacing Ribs in Umbrellas.—(1) The following shows how to replace a short, broken steel rib A' (Fig. 581). This rib generally breaks near the joint. Remove it in the following manner: Cut the stitches that fasten the cover to this steel rib at B', B², B³; then remove the broken steel by cutting with a pair of tinman's snips (cost, 1s.) the rivet that passes through joint A'. This is done by inserting snips S, as shown in Fig. 582. If the rivet is too hard to cut, file its head down and punch it partly out with a small steel punch sufficiently to get a grip of it with a pair of pincers to pull it out, leaving the umbrella with the cover partly open over the end of a table, G, as in Fig. 583. To do this, a flat iron, I, must be placed, with hole bored in it, under the rivet R. Next remove the other part of the broken steel by untwisting the wire W (Fig. 584) with a small pair of square-nose pliers. Then replace with steel taken from an old umbrella. See that the new steel is the same size from hole to hole as the broken one, or the umbrella will not shut up easily, and when it is open the cover will be a bit out of shape. Replace this steel on the wire W (Fig. 584), and fasten the wire again with square-nose

pliers. A ring of umbrella wire can be bought for 2d. Then fasten the other end. Put a ½-in. French nail through holes for rivet, cut off point with tinman's snips, lay on table (as in Fig. 583), and to rivet hammer lightly on flat iron; if hammered too hard the joint will not work easily. If the hole is too small in the new steel to be put in the umbrella, open the hole with bradawl filed square and tapering, shaped like a reamer. If the French nail is too thick, place it in a small hand-vice, and file it at the end of a table; rotate it between finger and thumb while filing, just as a watchmaker files a brooch-pin. Now fasten the cover first at B^1; open the umbrella to see if it works all right, then stitch through the seam at B^2, B^3, and it is finished. (2) To put in a rib when broken at C (Fig. 577), cut the stitches that fasten the cover to all ribs (B^1, B^2, B^3), lay cover back out of the way (as shown in Fig. 577), remove the broken steel by undoing the wire as in first case, put in new steel, draw cover back, and stitch first to the ends of steel (B^1, Fig. 581). The umbrella is closed for doing this. Take care to stitch to the right steels. Then open umbrella and stitch the seams to B^2, B^3 of steel (the umbrella being open for doing this). If there is sufficient metal left at the end of steel to drill a fresh hole, drill it with a small Archimedean drill. The bit with which to drill the hole can be made out of a broken darning needle. First heat the needle to cherry-red, hammer on flat iron, file to shape (D, Fig. 585), re-heat in fire to cherry-red, plunge in cold water, temper to light-straw colour in flame of lamp or candle, and finish on the oilstone.

Urn, Bronzing (*see* **Bronzing Copper**)

V

Valves, Grinding in

Special tools are not required for grinding in valves, unless the seatings have to be refaced because they are pitted. The grinding medium is either emery powder of various grades, fine sand, baked loam, or fine pumice-powder; the most suitable of these will depend on the purpose for which the valve is used, and on its size. If the faces are in a bad condition, but not so bad as to require refacing with a tool, the coarser grade of emery is first used, care being taken not to cut the faces into circular rings, using a finer grade as the grinding proceeds, and finishing with the finest, such as knife polish; small valves should be finished with pumice-powder and oil. The emery is made into a paste with ordinary lubricating oil. The grinding in is done as follows:—At the back of the valve there is a projection, either with a slot for a screwdriver, or a square for a box spanner. Raise the valve and spread a little of the emery and oil paste on the seating, lower the valve and twist it backwards and forwards, applying pressure with the left hand, and using any suitable lever to the screwdriver or spanner. Every few minutes turn the valve halfway round, and let it have plenty of emery and oil. Not too great a pressure must be applied, only sufficient to give the grinding medium a slight cutting action on the face of the valve. If the pressure is too heavy, especially with coarse emery, deep circular cuts will be made in the face of the valve. The process of grinding must not be too hurried, and the pressure must be evenly applied if a good tight joint is to be obtained. With large valves that are badly out of truth, and when a special facing tool cannot be used, the seating can be trued up by first trueing the face of the valve to the correct angle in a lathe; the face is then rubbed with a red-lead paint as used for facing slide valves, the valve placed in position, and a slight turn given, when all the high parts will be marked. These high places are taken off either with a fine half-round file or with scrapers, and this process is continued until the whole of the seating is marked, and afterwards finished by grinding with emery and oil. Loam is prepared by baking on an iron plate or shovel in a furnace fire, and after cooling is sifted through wire gauze or fine muslin. Baked loam and pumice-powder, not being so sharp as emery or sand, are used when a fine smooth surface is required. Some engineers maintain that emery is a wrong material for use in grinding valves made of soft metal such as brass, the emery bedding in the soft metal and ultimately scoring the surfaces in contact.

Vaporiser

A vaporiser may be made from a piece of soft German glass tubing, about 9 in. long and ¼ in. in diameter; each end should be held for a few seconds in the flame of a Bunsen burner until the glass softens and the sharp edge becomes round. When the glass is cool, it should be held so that the

flame just impinges on the tube about 3½ in. from one end, and the tube should be slowly revolved until the glass softens, when it should be drawn out, as shown in Fig. 586. The tubes should be severed at A, and each small point should be held in the burner for a few seconds to round it off also, care being taken that it is removed from the flame before actual fusion takes place. The two tubes are now placed together, as shown in Fig. 587, and held in position by a small piece of thin sheet brass, which is bent over at each end so as to grasp the tubes. The vertical tube is passed through a hole in the cork of a perfume bottle, and the vaporiser is now complete. By blowing through the horizontal tube, the perfume is raised in the vertical tube, and then scattered into fine spray by the blast.

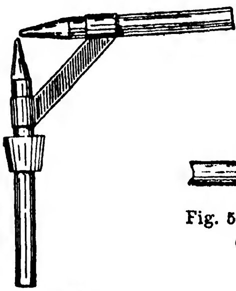


Fig. 586.—Drawing out Glass Tube.

Fig. 587. Vaporiser for Toilet Purposes.

Varnish and Varnishing

Varnishes are of two main classes—oil and spirit. The former cannot be made satisfactorily at home, and their application is a matter of extreme care, success depending on cleanliness of surface, brushes, and utensils, absence of damp, and the avoidance of mixed brands of varnish, no two different varnishes ever being mixed together; in fact, the handyman should never thin varnish, the manufacturers supplying it in the best possible condition for use. Spirit varnish can be made fairly satisfactorily at home. To be successful in the use of spirit varnish, the worker should be somewhat acquainted with french polishing. Unlike oil varnish, spirit varnish, as a rule, does not flow level from the brush. The beautiful level surface of oil varnish, as seen on carriage bodies, is gained by allowing the first coat to get perfectly dry, and then rubbing it down smooth by means of pumice in lump or in powder, before applying the next coat. The same principle underlies the successful use of spirit varnish. Each successive coat should be levelled by the aid of fine glass-paper or the polish-rubber; and it will further tend to success if, before any varnish is applied, the pores of the wood are sealed, either by the aid of a coat of size or by filling in and spreading over the work a few good rubbers full of polish. For small work the latter plan is recommended. Its object is twofold: it prevents the absorption of varnish by the unclosed pores of the wood, and keeps down the grain, which otherwise is apt to rise. The following hints should be observed in applying spirit varnish: Dip the brush well into the varnish and lay it on across the grain, beginning at the least exposed portions of the work, so that in case it has to be handled the more prominent parts may not be marred. The varnish can should be provided with a wire or bar soldered across the middle of the mouth. Dip the brush as may be required, wipe it off on this bar, and lay off on the work as before. Stab the brush well into angles and corners. When the whole surface has been roughly covered, wipe the brush again on the bar, removing all the varnish possible; then lay off the work with the grain of the wood, draw the brush backwards and forwards, and wipe it again if necessary. Repeat this operation until a perfectly level surface is obtained. Any grooves or depressions in the work will retain more varnish than the plain surface, and to prevent the surplus running down, the brush must be stabbed in and drawn out towards the main surface. The last coat of varnish introduced will make a very good job if the underneath coats of varnish and shellac respectively have been treated carefully in the manner described.

Black Varnish (*see* Optical).

Brown Spirit Varnish.—This is made of shellac, 2 lb.; gum sandarach, ½ lb.; methylated spirit (60° over-proof), 1 gal. Shake until the gums are dissolved, and add warmed Venice turpentine, ¾ lb. Shake until thoroughly mixed, and afterwards strain. It should be kept for a week or ten days previous to use. Another spirit varnish is

made of 4 oz. shellac, 2 oz. resin, ½ oz. gum benzoin, ½ oz. gum thus, 1 pt. methylated spirit. Crush the gums, pour in the spirit, and set aside in a warm place, frequently shaking the bottle. Carefully strain before using, and apply with a camel-hair brush, having no loose hairs.

Brushes for Applying Spirit Varnish.—Those made of camel-hair of the kind known as gilders' mops are strongly recommended, the majority of them being far superior to those inserted in wood handles, whether round or flat. Those in tin should be avoided unless they can be washed out in methylated spirit and put aside when not in use. For domestic purposes, the varnish should be kept in a large-mouthed glass bottle, with the brush suspended from the cork. Glass or earthenware jars only should be used. Varnish containing shellac has a sort of corrosive action on tin, causing the varnish to turn dark coloured and to smell disagreeably.

Furniture Varnish.—White furniture varnish is made of bleached shellac, powdered, 2 oz.; spirit, 1 pt. Dissolve the shellac in about two-thirds of the spirit, filter, add first one-third of the remaining spirit, and afterwards dilute with the remainder. A reddish varnish may be made in the same manner by using orange instead of bleached lac, and a still darker one by the use of a very dark lac, with the addition of a little extract of sandal-wood.

Shellac Varnish.—There are two varieties of shellac—orange and white. They may be bought dissolved in spirit of wine ready for use, and also dry in the shell-like lacs. If purchased in the lac, to prepare for use, dissolve 2½ lb. of the white or 2 lb. of the orange shellac in ½ gal. of methylated spirit.

White Hard Spirit Varnish.—The best white hard spirit varnish is made by dissolving fine picked gum sandarach, 2 lb., in methylated spirit, 1 gal. Strain and add finest pale turpentine varnish, 1 lb. Another and a dearer kind is made of gum mastic, 2¼ lb.; spirit, 1 gal. Dissolve, and add 1 lb. finest pale turpentine varnish.

Vegetable Parchment (*see* Parchment)

Vellum

Cleaning Vellum.—The following method, if carried out carefully, will restore dirty vellum to its original condition. Place the vellum on a board, and damp it well with a sponge, water being applied to both sides. The vellum will then get limp and will stretch. With the dressed side uppermost on the board, drive tacks well in round the four edges, pulling the vellum outwards meanwhile as tightly as possible. Allow the vellum to dry naturally, when it will be found that all the creases have disappeared. To remove any obstinate dirt or stains, after the vellum has become dry, and while it is still tacked to the board, wash it with a weak solution of oxalic acid, say a pennyworth of acid dissolved in a pint of water. It may be stated that in all skins of vellum there are transparent patches and certain natural marks, which, of course, will not be removed. (*See* "Parchment.") Vellum must not be touched with glasspaper, as this would spoil it completely. If it is thin and is intended for a book cover, it should be lined with white paper. This is best done by again tacking it on the board with the undressed side uppermost, pasting the paper, placing it down, and rubbing it thoroughly, afterwards allowing it to dry in this position.

Cleaning Vellum of Banjo.—Slightly slacken the bracket screws, then rub the head with a flannel and cold water; a little soap should be used if necessary. Tighten up the head again whilst still damp.

Colouring Vellum.—For a green dye, take 1 oz. of verdigris and 1 oz. of white wine vinegar, and place in a bottle near the fire for a few days, shaking it three or four times a day. Previous to applying the dye, wash the vellum with a weak solution of salt of tartar. Then, when dry, wash with the green solution to the shade required. For a red dye: To 1 pt. of white wine vinegar add ¼ lb. of Brazil dust and a small piece of alum. Cork the mixture up, and let it stand in a warm place for a few days before applying. There are one or two points to be attended to before apply-

ing the stain. First wash the surface of the vellum with a soda solution, to destroy the oily nature of the surface; or this may be done by merely damping the surface with hot water. Before damping and colouring the skin, it should be well tacked down to a flat board and allowed to dry while still tacked to the board. To give a finish to the surface after colouring, paste it all over carefully and rub with a folder or tooth-brush handle, and then wash off the paste. During the final washing, some of the colour will wash out, so allowance must be made for this when applying the stain. It will be advisable to practise with small pieces, carefully noting results.

Mounting Vellum Certificate.—Ordinary flour paste or thin glue may be used. Cut the cardboard neatly to give a margin of 1½ in. all round. Lay the certificate on a piece of clean paper, and with a brush paste it carefully all over. Then lay it in position on the cardboard, with a sheet of white paper on top, and rub it into contact with the board, using the heel or fleshy part of the hand. Afterwards, with the paper still on top, rub down with the handle of a tooth-brush or similar tool. Care must be taken to work quickly, so as not to allow the damp of the paste to disturb the ink or colouring of the certificate. If glue should be used, there would be less fear of trouble with the colours, but in the hands of a beginner, paste is cleaner and easier to work.

Velvet

Cleaning Velvet-pile Table Cover.—First remove all dust by hanging the table cover up and carefully beating it; next treat it several times with benzene, pressing each time so as to remove all the dirty liquid; then hang it in the open air to dry. Of course this dry cleaning should be done in a room in which there is neither fire nor artificial light. After thoroughly drying, if the table cover is not sufficiently clean, lay it on a table and carefully sponge it all over with a mixture of equal quantities of methylated spirit and water. Do not wet it more than is absolutely necessary, and immediately dry it by pressing dry, clean linen cloths upon it. Again dry the cover, and brush it carefully with a moderately stiff brush to raise the pile.

Renovating Crimson Velvet.—The following is a good method of raising the pile of a crimson velvet chair-seat cover. First take off the velvet covering, as probably there will be an under-cover of calico or hessian, and the stuffing will not be disturbed. Now heat an ordinary flat-iron and cover it with several folds of wet cotton cloth. Fasten the iron by the handle, face uppermost, in a vice, and, as the steam rises, pass rapidly the wrong side of the velvet backwards and forwards over the face of the iron; finish by brushing up the nap with a soft brush. Another method is to fill a clean tin can with boiling water, cork up, and lay it on its side. Slowly pass the velvet over the can, and as the steam comes through, brush up the pile.

Veneer

Removing Veneer.—Old veneer may be removed by heating a flat-iron and pressing it well against the veneer; the latter can then be readily prized up by means of a stout knife or chisel. The old glue can be removed with hot water and rag; the rough surface can be re-veneered, or it may be planed up and glasspapered in order to leave a surface fit for polishing. Veneer cannot be taken off in such condition as to be fit to relay again. Instead of the method given above, it can be planed off.

Venetian Blinds (*see* Blind *and* Painting)

Violins

Amber Varnish for Violins.—Amber varnishes for violins are prepared in many shades, according to the class of amber used, and the paler the varnish the more expensive the gum. For a cheap quality, fuse 3 oz. of dark brown amber over a fire in a suitable vessel (copper preferred), then add 6 oz. of pure boiled linseed oil previously heated, and boil both together until the mixture turns stringy. Allow it to cool somewhat, and slowly stir 12 oz. of American turpentine into it. Leave it for about fourteen days, when it is ready for use.

To apply the varnish, rub down all inequalities with No. 0 glasspaper and with chamois leather, next apply a coat of the varnish, which should be well rubbed into the wood and allowed to dry; then the second coat should be applied thinly and evenly. The room in which the varnishing is accomplished should be at a temperature of not less than 90° F., which gives a brilliant and durable finish to the work.

Cleaning Violin.—The cleaning of a violin incrusted with dirt and resin is described in the "Bazaar," which recommends rubbing it with a rag moistened in paraffin oil, renewing the oil as required; water must not be used. Rub patiently and carefully, and the dirt will be removed. Many instruments have been blackened under the bridge and around the end of the fingerboard to give the appearance of age and use, and too much rubbing on that portion may cause the white wood to show. Much depends on the class of violin. The artificial blackening and powdering with resin is frequently so skilfully done that it cannot be removed without injuring the appearance of the violin; and it is also often so artistic as to be quite a decorative feature. In such cases, nothing more is done than to clean away lightly, as above described, the surface accumulations of dust, etc., and polish up with a piece of dry, soft cotton. Ordinary paraffin oil is volatile, and its smell speedily disappears. Of course, care should be exercised not to slop it about the soundholes.

Remedying Worm-eaten Violin.—Worm-eaten violins are those, generally, that are old and, as a rule, are therefore all the more valuable. Many of the violins made during the sixteenth, seventeenth, and later centuries have been disfigured and have had their tone destroyed by the ravages of woodworms or bacilli, and though in some cases they were fumigated, the instruments, once attacked, were soon beyond redemption, and new wood had to be inserted, often in vital parts. Among the remedies which have been proposed is nitric acid diluted with fifty times its volume of water; but this, besides killing the insects, stains and corrodes the wood. Other supposed remedies are solutions of picric acid and mercuric chloride respectively, but these hasten the decay of the wood. Hermann Muller, a San Francisco violin maker, experimented for years with all the known supposed remedies, none of which was found satisfactory; but he discovered that good results were given by aqua dioxide hydrogenii, which is a solution of peroxide of hydrogen (H_2O_2); this does not injure the wood, but destroys insects and bacilli. Hydrogen peroxide is a colourless and odourless liquid, and though said to have been used first by Thénard in 1818, its properties as an antiseptic and deodorant have become known during late years only. The commercial 15 per cent. solution may be applied with freedom and with safety to any insect-eaten violin.

Varnishing Violins.—It is not usual to stain violins, better results being obtainable by incorporating the colouring medium with the varnish. Tone gradations are got by rubbing off with fine pumice-powder and water as much of the coloured varnish as may be required to gain the desired result, and then building up the surface that has been thus reduced in thickness by applying one or more coats of varnish free from colour. Next the varnish is ground down level by pumice, and one or more coats of clear varnish are applied all over. The surface to be varnished having been well smoothed down with No. 0 glasspaper, go over it with a sponge slightly damped with clean water. When dry, smooth it down again with glasspaper, repeating the process till a smooth, dead surface is obtained. Then fill up the pores with copal varnish, using 4 parts of varnish to 1 part of turpentine. Make this hot by setting the jar in an oven, applying whilst it is still hot by means of a stiff brush, and before it has time to harden clean off the surplus by means of wadding enclosed in fine, soft rag, making the pad wet with turpentine. In a few hours, when the varnish left in the pores has had time to dry, apply the spirit varnish. For a reddish tone, colour ¼ pt. of methylated spirit by adding a dessertspoonful of red sanders or one penny-

worth of dragon's blood. In another bottle dissolve 2 oz. of white shellac (previously crushed small and dried), 2 oz. of gum sandarach, and 2 oz. of Venice turpentine in ½ pt. of methylated spirit. Carefully strain the two through fine muslin into a clean bottle, and apply to the violin with a camel-hair brush as evenly as possible. Give three or four coats, applying one daily till the desired colour is obtained. For a self colour, simply dull with pumice and water. If, however, gradations of colour are desired, the pumice must be used more freely on some portions than on others, and the surface must be built up again with clear varnish as advised. Next cleanse the surface by careful washing, then bring up the lustre again by well rubbing with tripoli and water, or crocus and linseed oil applied with cloth or felt, and impart the final gloss by a brisk rubbing with the ball of the hand and flour. If tripoli or crocus does not produce a high-grade finish, the surface may be brought up by french polishing, or a finish may be obtained by a coat of clear varnish if carefully laid on.

Vulcanite

Vulcanite is a form of indiarubber which has been vulcanised with a large proportion of active material (sulphur, etc.), the heat being maintained for a long time. Black vulcanite is called ebonite (*which see*). The best qualities of vulcanite show, when fractured, a lustre somewhat resembling that of jet, and the poorer the quality the lower the lustre. Although easy to machine, vulcanite is hard on tools, and in sawing, turning, planing, or milling, the best speed is that at which brass is machined. In milling there should be a free use of soap and water. Lubricants should not be used when turning or sawing. Vulcanite is easily shaped. For example, to form a spout in a vulcanite dish, soften a corner in boiling water and mould the material to shape with the fingers. Then set aside until cold and set.

Polishing Vulcanite.—Assuming the vulcanite has been turned and finished with a scraping tool, the article should be fairly smooth. However, emery in any form must be avoided. Take a handful of vulcanite shavings and apply these as the article revolves. Next prepare a piece of soft linen (a surgical bandage will do) by soaking in any sort of common oil, and sprinkle one side with putty-powder (oxide of tin), then loop the prepared side round the article, holding the ends firmly with both hands, and work it evenly all over the article while the lathe is running; now finish the polishing in the same manner with a clean piece of linen without any polishing medium.

Straightening Vulcanite Plates.—Put the plates in moderately hot water, then place each between two smooth boards and screw these together tightly until the plates have become cool again. Several ordinary screws fixed in the boards around the plates will serve the purpose.

W

Walking Sticks

WALKING STICKS of all kinds are best cut in winter, from October to February. The leaves are then off, and the character of the stick is more easily seen; also, the sap being inert, the stick when cut will dry quicker and better. The kinds which are most easily got from English hedgerows, and which can always be depended on to do good service, are hazel, ash, and blackthorn. They should, when possible, be taken from saplings, all top wood being quite useless. Hazel sticks are very light, usually straight, and always handsome and reliable. Ash sticks are the toughest of any, the best being saplings known as ground ash; blackthorn and whitethorn are liable to brittleness, but, when large, are just the thing for those who prefer a very heavy stick. Elm, maple, holly, crab, apple, willow, and some others, are very seldom of any use, besides being more difficult to get. The tools necessary for stick cutting are a small hand-pick of some kind, a small saw (a broken turning saw will do very well), and a stout clasp-knife. Walking sticks as taken from the hedge are very rough-looking things, as there is always plenty of superfluous wood left on to be trimmed up when the stick is dry. Suggestions as to the way in which the handles may be trimmed are shown in Figs. 588 to 593. To make a stick dry straight, soak it in hot water and hang it to a beam for five or six weeks, with a heavy weight at one end. A coat of boiled linseed oil given occasionally while drying will greatly add to the toughness of the stick. When trimming up the handle, the first consideration is to choose a shape smooth to the hand; and, in carving, bold designs give best results. Finish with french polish or spirit varnish.

Ash, Seasoning, for Walking Sticks.—To season wood and prevent it from cracking and splitting, it is usual to dry it slowly in a cool place with free access of air to all parts. In the seasoning of ash sticks the following precautions should be taken:—The cut ends should be tightly bound with fine soft copper or brass wire, firmly fixed in ferrules, or fitted in pieces of gas barrel. They are best seasoned in boxes of dry sand, in which they are laid straight, side by side, and then heavily weighted to keep them from warping whilst being dried. Ash saplings pulled up by the roots should have their roots bound tightly with soft wire, and then the sticks should be hung up in a cool room, with their roots upwards, and their heads weighted with a heavy weight to each stick. If left like this during the winter they will dry without warping or splitting. Lateral branches and long roots should not be cut close whilst the sticks are green, as this is often the cause of cracking during seasoning, and can be safely done after the sticks are seasoned.

Ash Walking Sticks. Good strong walking sticks may be made out of 4-ft. strips of well-seasoned ash, $\frac{3}{4}$ in. by $\frac{1}{2}$ in. Each strip (Fig. 594) should first be hung up for a fortnight, with a weight attached to prevent warping. When ready for bending, select the end of the strip having the straightest grain, and wrap it round, for about 1 ft., with a cotton band, as shown in Fig. 595. Now place a large pan of water on the fire (*see* Fig. 600) and put in it the bound ends of as many rods as it will conveniently hold, supporting them on the back of a chair or other article, as shown. Such a vessel

must be used as will allow the water to reach beyond the part where the bend will be; and the lid should be utilised for shutting in the steam as much as possible. After the rods have been boiled for about an hour, they should be taken out of the vessel and the ends bent round a paint tin or similar article, as shown in Fig. 596, to form the handle; they are then tied securely with string, over the cotton binding, and left for a day or two to set. There flaw may be worked out with the spokeshave, and yet leave the stick sufficiently strong, after it has hardened, for a lady's use. In selecting the ash rods, choose those with the straightest grain, which should appear as in the end view (Fig. 602). The bending should be inwards towards C, where the grain shows the centre of the tree to have been. After being very finely glasspapered, the sticks should be stained and french polished.

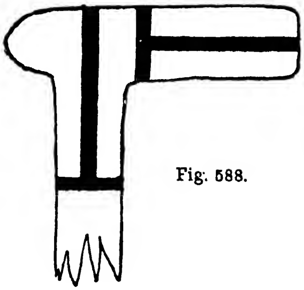


Fig. 588.

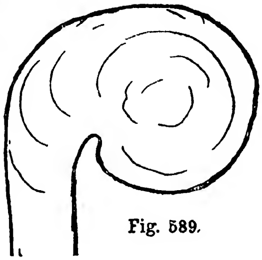


Fig. 589.

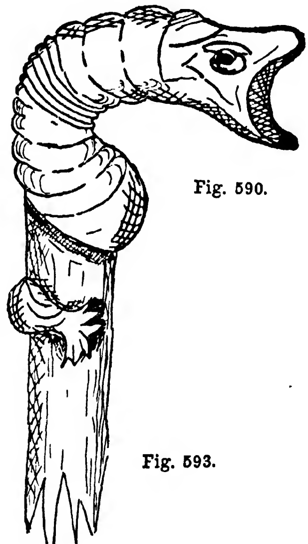


Fig. 590.

Fig. 593.

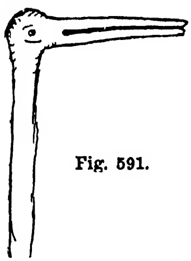


Fig. 591.

Fig. 592.

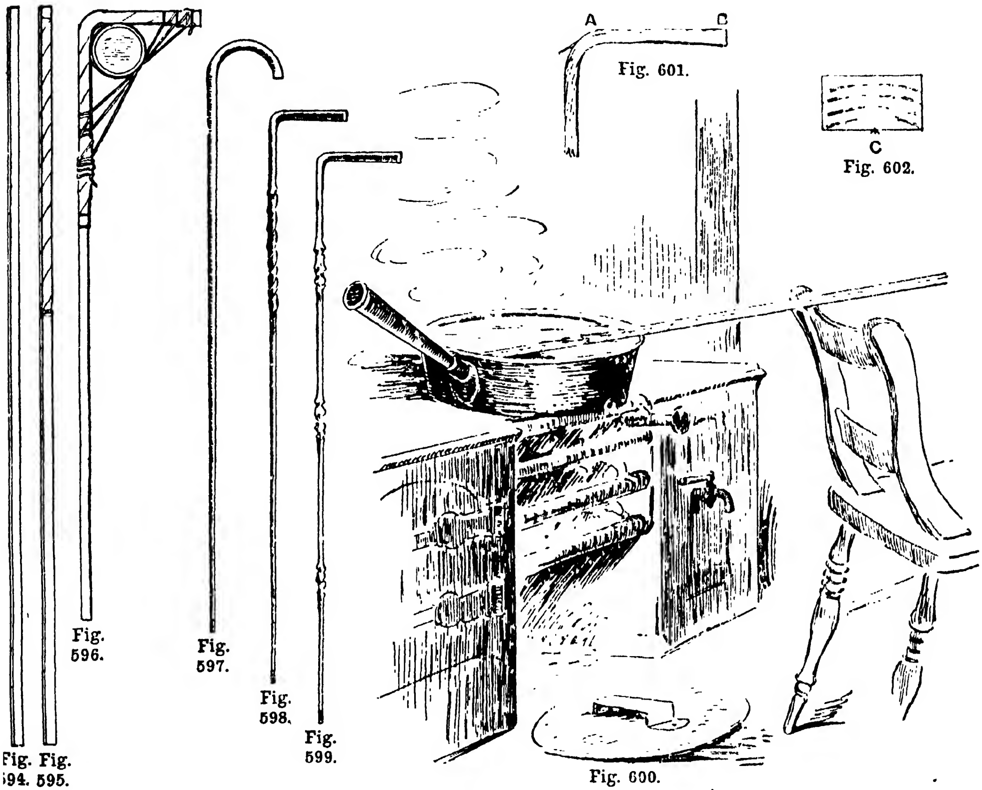
Figs. 588 to 593.—Walking-stick Handles and Knobs.

are other methods of steaming, but this will be found to give very good results. After the sticks have been bent and dried, they have to be reduced to a convenient weight and shape. The surplus wood gives opportunities for original treatment. The sticks may be plain and tapered, as in Fig. 597, or worked as in Figs. 598 and 599. When the handles are left straight, they will look better if they are made thicker at the end B (Fig. 601) than at A. Special care should be taken, when bending over the handle, that the grain of the wood at the bend A does not run out as shown, or, in spite of the wrapping, a burst is liable to occur. If this should happen, the

Black Polish for Walking Sticks.—Dissolve about 6 oz. of garnet shellac in 1 pt. of methylated spirit; the dark colour can be intensified by adding $\frac{1}{2}$ oz. of black aniline spirit dye. To convert the above quantity into a spirit varnish, add 2 oz. of gum copal, $\frac{1}{2}$ oz. of gum mastic, and $\frac{1}{2}$ oz. of pale resin.

Blackthorn Walking Sticks.—It is not usual to peel blackthorn walking sticks. The knots are trimmed off neatly with a sharp knife or a small plane, then polished with glasspaper and varnished, or given a dressing of linseed oil. If the bark is very rough, this also is rubbed down with fine glasspaper before it is varnished.

If, however, the bark is to be taken off, try the effect of steam on it, or soak the stick in very hot water for some time and thus endeavour to loosen the bark. When it is loosened, it may be scraped off with a blunt knife. The stick must be then dried, rubbed with glasspaper, and polished.



Figs. 594 and 595.—Ash Rod, Plain and Bound. Fig. 596. Bending Handle of Ash Stick. Fig. 597.—Tapered Stick with Curved Handle. Figs. 598 and 599. Ornamental Sticks with Straight Handles. Fig. 600. End of Stick Immersed in Boiling Water. Fig. 601. Handle with Defective End. Fig. 602. End View of Grain of Ash Rod.

Cementing Silver Tops on Sticks.—Wax cement, to be obtained from any wholesale umbrella materials dealer, is used. A good substitute can be made by melting slowly together 1 lb. of bottle wax, 12 oz. of resin, and 8 oz. of pitch, and well incorporating by stirring.

"Congo Cane" Walking Sticks.—These are made of the common overgrowth of wood that springs up from the stumps of ordinary chestnut trees soon after the latter have been felled. For a few years France alone produced these sticks, but now large tracts of land in the provinces of Croatia and Krain, in Austria and Hungary, where the chestnut is abundant, have been rented by Austrian capitalists. Something like a farthing is paid for each stick that is taken away. The stick cutters are men working ten hours per day for a wage of 80 kreuzers (about 1s. 4d.) per day. Care is taken in the early spring to obtain

a good crop of sticks, the workmen going into the chestnut groves with nippers; every stick that is to be cut later in the same year must first be nipped. March is the best month for the nipping process, as then the shoots begin to sprout. In the autumn the sticks are ready to be gathered, having by then attained an average length of 6 ft. 6 in., and a thickness at the largest part of about $1\frac{3}{5}$ in. Undersized sticks must also be taken in the autumn and paid for at the regular price; they are bent and prepared to serve as umbrella handles.

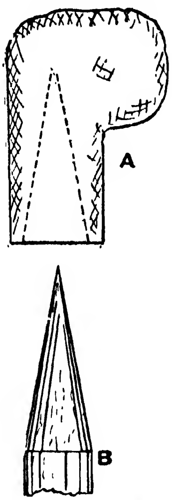


Fig. 603. Joining Handle to Walking Stick

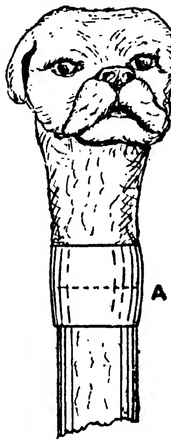


Fig. 604. Carved Handle for Walking Stick.

The fully grown sticks are stripped of twigs and thrown into boiling water to loosen the bark, which is then peeled off in its hot state by the bare hands of the workmen. The sticks, after further dressing, are ready for export.

Ebony Walking Sticks, Renovating.—To renovate ebony walking sticks that are marked and bruised, remove the worst bruises by means of a steel scraper, the edge of a knife, or glass, finishing with fine glasspaper. Wipe over the light places with ink, smooth down again, then apply with a camel-hair brush, first to the bare portions, and, when equalised, all over, a black varnish made as follows:—6 oz. of best pale orange or lemon shellac, 4 oz. of best gum benzoin, $\frac{1}{2}$ oz. of aniline spirit black, and 1 pt. of methylated spirit. Shake frequently till dissolved; carefully strain through muslin; add more spirit afterwards if too thick. Use it in a warm room.

Fixing Horn Handle on Walking Stick.—Below is shown how to fix the horn head of a walking stick to an iron screw dowel that is firmly fixed in the stick itself. It is assumed that a hole in a horn handle has worn too large for the dowel screw to grip. If so, a new screw of larger gauge is necessary. Screw the horn on the screw first. If the screw is tight and there seems danger of splitting the horn, warm the screw in a flame and screw home whilst hot, and then immediately immerse in cold water. There is no cement that will make a firm join. A wooden plug might be tried, but it will be difficult to get the old screw into it, as the plug will probably wind out. Fill the silver mount with wax cement or sealing wax, and screw the handle up tight whilst the wax is fluid.

Fixing Silver "Nose" on Walking Stick.—To fix the nose, put inside it a little wax, also smear a little on the end of the stick, press the nose on, and hold it sufficiently long over a gas-burner to melt the wax; then press firmly home, taking care not to burn the stick or to get the mount too hot. The nose may be made further secure by putting in a small pin. Trim off any stray wax when cold.

Ivory Walking Stick, Straightening.—Procure a length of dry deal or pine 30 in. (or less) by 3 in. by 2 in., and along it run a straight groove with a round-nose plane the size of the diameter of the stick; secure the stick with narrow lead staples in the groove, and stand in the sun. Turn the stick in its bed daily until it is straightened.

Joining Handle to Stick.—To join a wooden handle to a stick, one way is first to rough out the handle, as at A (Fig. 603); bore a hole with a small bit, and enlarge and taper this with a hollow taper bit or wood reamer, as shown by the dotted line. Taper the end of the stick, B, to fit the hole, and when a good joint is made, glue

it on and allow to dry; then clean off level at A (Fig. 604), and carve or shape the handle to some suitable pattern. The joint at A may be concealed with a ferrule.

Oak Walking Stick, Darkening.—As oak sticks contain tannic acid, they may be easily darkened to any shade by applying those substances which combine with tannic acid to form a black dye. All solutions of iron will do this. Iron rust, dissolved in acetic acid, vinegar, or sulphuric acid, forms iron acetate or iron sulphate. Dilute this with water, brush over the sticks, dry, and repeat until dark enough. Another shade may be got with bichromate of potash dissolved in cold water; another, with strong liquor ammoniæ, either by brushing or holding over the fumes; other shades with logwood, lime, potash, and soda. Green walnut shells will also darken oak. When dry, rub with rough canvas, dress with boiled linseed oil, again rub when hard, then varnish with copal or hard spirit varnish.

Polishing Walking Stick.—To fetch out the figure, wipe over with raw linseed oil by means of a pad of wadding or flannel. If the polish is applied with a camel-hair brush it will need more smoothing down with finest glasspaper and a trace of linseed oil. In either case, apply a fair body of polish, and finish bright and level by friction. In most cases this finish is gained by the application of one or more coats of best spirit varnish; but, as french polish does not always wear well outdoors, use oil varnish, such as church oak, or coach-finishing varnish. French polish is made by dissolving about 5 oz. of best orange shellac in 1 pt. of methylated spirit. It should be kept in a glass or stone jar, and has a corrosive action on tin.

Repairing Ebony Stick.—Ebony walking sticks are cut from the solid wood, and are extremely difficult to repair when broken at a bend in the handle. However, mix up a little fresh glue not too thick, slightly warm the broken edges, and glue them together as tightly as possible. If there is a vice handy that will open wide enough to hold the crook, it can be used, a piece of wood being placed across the inside of the crook so as to bring most of the vice pressure on the join. The stick should be left for at least twenty-four hours to set properly; then drill a hole with a Morse bit so as to cross the fracture and insert an ordinary wood screw, its head being countersunk below the surface of the wood. Fill up any crevices and the head of screw with black sealing wax rubbed in with a bit of red-hot wire, and finish with an old file and glasspaper, afterwards staining with a good ebony stain and then polishing.

Repairing Walking Stick.—If the breakage is rather long, the stick may possibly be repaired by simply gluing the broken pieces together. This will make a neat job if carefully done, and if good glue is used the joint will stand for years. Make the glue rather thin. Warm the pieces to be joined, cover them with glue as hot as possible, put the pieces together, and bind firmly with a piece of tape or string, taking care to squeeze out all superfluous glue from the joint. If the breakage is ragged, it will be necessary to plane both pieces to a bevel about 4 in. long to form a splice. Allow the glue a couple of days to dry before removing the binding, and then clean off. When a fishing-rod is spliced in this manner, it is the usual practice to wrap the joint with waxed thread; but this would look rather unsightly on a walking stick.

Shark's Backbone Walking Stick.—If the shark's backbone is at present in a dried, and therefore hard condition, remove the spinal arches with a knife. Then, with a rasp, the edge of a piece of glass, and glasspaper, make it as nearly as possible round. Soak then in water until it becomes quite pliable, and, attaching a heavy weight to the lower end, hang it up to dry. For a bent handle, secure the upper end over a circular beam. Finish off, when perfectly dry by further smoothing down with glasspaper, fixing a ferrule, and french polishing.

Varnishing Walking Sticks.—The soft gums that are used in the manufacture of spirit varnishes are apt to soften and rub off under the constant chafing of warm hands, so that if varnish is used on the heads of the sticks and afterwards finished out with polish, the film of shellac that is left by the polishing will be insufficient to form a

hard protective surface. Thicker polish on the heads would give better wearing results, especially if free from any colouring matter; staining should be done before applying polish or varnish. French polish or spirit varnish, though giving a pleasing finish to sticks, does not wear so well as the polished goods of manufacturers. Stick makers, for both walking sticks and umbrellas, turn out vast quantities, and use proper drying stoves by which a hard enamel surface that is not obtainable by air-drying varnish is produced.

Weighting Walking Stick Handle.—Fig. 588 (p. 542) shows how to weight a stick with lead. Holes are bored, as shown, and then, if something is wound round the stick at the cross-hole to keep the metal from running out, and the molten liquid is poured in at

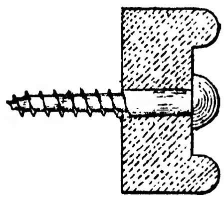


Fig. 605.—Wall Protector.

the end of the long holes, it will form a T inside the wood, and it will be impossible for the lead to fall out when cold.

Walls

Damp-proof Composition for Walls.—The following preparation, which resembles varnish in appearance and handling, will be found useful for first coating gable ends, cellars, and damp walls, particularly where paper and paint will not adhere. It forms a firm foundation for painting or paper-hanging by preventing the damp striking through the walls. The ingredients are:—Pale or colourless resin 14 lb., coal-tar naphtha or benzene 1¼ gal., pale oak varnish 1½ pt., boiled linseed oil 1 pt., and zinc white paint 3 lb. Melt the resin in an iron pan, move well away from any fire or lights, and add steadily, whilst continually stirring, the oak varnish and boiled oil, both of which should have been warmed previously; then add the naphtha. Dissolve the zinc white in a small quantity of the naphtha, add to the preparation and thoroughly stir. Allow it to cool, and if thick, add more naphtha. This preparation may be coloured with paste paints thinned with naphtha. If a brick-red colour is required add Venetian red paint, or for colourless and transparent composition omit the zinc white paint. For porous or highly absorbent brickwork, render the composition more fluid with naphtha for the first coat, so as to penetrate the bricks; the second coat will effect a certain cure.

Plugging Walls (*see* main heading, "Plugging").

Removing Limewash from Walls.—To remove limewash from a wall, dilute some commercial hydrochloric acid with ten times its weight of water, and apply this with a brush. When all the lime is removed, wash the wall down with water.

Wall Protectors for Chairs.—To protect walls that are painted, papered, or stained, from being marked or bruised when chair backs are placed suddenly or carelessly against them, the following device may be used:—Procure some indiarubber buffers, as sold by rubber merchants, and some round-headed screws, and fasten the buffer to the part of the chair back that first comes in contact with the wall, as clearly shown by Fig. 605. If the chair back has much curvature, only one buffer is required, but if the back is only slightly curved or flat, two buffers may be used.

Wallpaper and Wall Hangings

In selecting wallpapers, says "The Plumber and Decorator," remember that all the rooms in a house should form one colour scheme, and that all the papers should be in somewhat the same style. The hall and staircase may have a richly coloured paper with a vigorous and pronounced design. More delicately coloured paper is suitable for the drawing-room, but it should have a bold design, as it is required to form a background for furniture. The dining-room, being mostly seen by artificial light, which modifies colours, should have a paper richly and brightly coloured, with a pronounced design. Bedroom wallpaper should be of a delicate tone, with an easy,

flowing pattern. Cool colours should not be used in rooms facing north, nor warm colours in rooms facing south. Papers for whitewashed walls or ceilings should be soft and pliable; if they crackle when crumpled in the hand, or stretch to a very marked degree when wet, they are apt eventually to crack. Notes on artistic wallpapers in the "Decorator" mention that a plain-surfaced paper forms a more satisfactory background for pictures than a patterned paper. If a pattern must be used, such papers as the Rottman, Essex, and similar kinds could not be improved upon. A very conventional design, with plenty of vertical lines in it, composed of dark shades of blue-green, brown-green, or red, looks well in conjunction with the usual gilt-framed oil paintings. Still, Mr. Fletcher Clayton thinks a plain wall is the best. Distemper has often been used for the walls of living rooms, but is rather coarse. For kitchens, sculleries, store-rooms, etc., nothing could be sweeter or cleaner, but a good paper or canvas is more comfortable to live with. As dust is constantly entering houses, the paper would be more serviceable than the canvas, unless this is painted and varnished. When used for the ground of a frieze in a dining or entrance hall, distemper is quite suitable, and does not look bare. There are several kinds of plain-surfaced papers which might be used for living rooms. A good quality of lining paper would do for bedroom walls, which do not have to stand the wear and tear of the ground-floor walls. For the latter rooms there are ingrain papers—quite plain, striped, spot pattern, counterchange, shot pattern on stripe, and others. There is an imitation ingrain paper (coloured on one side only) which might do for cheaper work. If a stout paper is used, and the joinings show (in spite of all precautions, and in consideration of the lighting of the room), a stencil pattern or sprig placed at intervals along the seam will help to disguise it. The following suggestion, carefully worked out, might look well. Supposing the ingrain paper be plain greenish-blue in colour, the stencil might be done in bluish-green, thus producing a slight contrast without upsetting the main colour scheme. Mr. Clayton prefers a 5-ft. to 6-ft. dado and a deep frieze.

Anaglypta, Hanging.—All but light quality Anaglypta should be trimmed with a metal-edged straightedge and a sharp knife, such as a shoemaker's knife. The material having been cut to the required lengths and trimmed, it should be pasted with ordinary paperhangers' paste. Let it stand for fifteen to twenty minutes, then cover it with ordinary paste to which is added one-fourth glue. Now hang the material at once before it commences to dry. Use a cloth for pressing the Anaglypta to the wall, as a roller presses down the relief. Lincrusta is done in a similar manner, but for this a roller can be used, as the relief is solid. A better finish is gained by first lining the ground with a common brown paper—the commoner the better. Ordinary colours may be used for painting relief paper—a preliminary coat of size will stop excessive suction—but only certain patterns lend themselves to ornate decoration. All the embossed papers look well applied to walls as dados if capped with a dado rail, and finished in plain colours and varnished.

Cleaning Wallpaper.—To freshen up wallpaper, rub briskly and well with cotton, flannel, or flannelette, using a fresh piece as the old one becomes dirty. If necessary, continue the rubbing, but use the freshly-cut side of a stale loaf of bread; rub always either vertically or horizontally, and do not cross the rubs. Wallpaper may be cleaned by first brushing it down and wiping with a clean chamois leather to remove loose dust, afterwards rubbing with stale bread. Two or three thicknesses of clean blotting paper laid on a grease spot, and kept in position for a short time by firm pressure with a hot iron, will generally remove such blemishes. Benzene, carefully applied, is also effectual.

Emdeca Wall Decoration.—Emdeca wall decoration is fixed with paste made up as follows:—1 part of white-lead (by weight) to 2 parts of whiting, well ground and thoroughly mixed with ordinary varnish or gold-size into a slightly liquid mass. Apply this paste with a trowel to the back of the sheets in a thin, even layer, and

then fix them to the wall or ceiling, applying equal pressure with the flat of the hand. The sheets should touch each other closely at the joints, and any paste remaining on the face of the material must be wiped off immediately with a soft rag. Emdeca should not be fixed to cement walls, unless the walls are from six to twelve months old. The proper system of fixing is shown in Fig. 606. Commence at the plumb line, and work from the centre towards the ends.

Lincrusta, Hanging.—A good paste for fixing is about half each of flour paste and glue. Make the paste, dissolve the glue by heat, and then mix. The glue will require to be thoroughly amalgamated

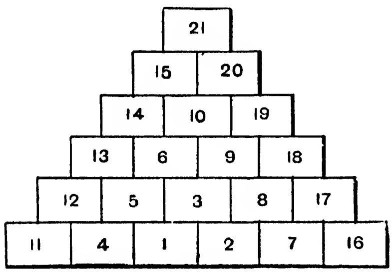


Fig. 606.—Fixing Emdeca Wall Decoration.

with the paste, and the latter should be properly made, and free from lumps. This is the paste used generally by the trade for Lincrusta, Japanese paper, Anaglypta, etc. Trim the Lincrusta with a cobbler's knife and straightedge upon a bench, cutting the material slightly inwards from the face, and so ensuring the face of the joints meeting nicely. The roller must not be used on such materials and designs when rolling is likely to injure the "relief" or raised parts. A few small upholsterer's gimp-pins should then be tacked in to keep the joints well down until the paste sets. The heads of the pins will not show if they are light or dark, according to the colour of the material. The lengths of Lincrusta and any other thick and heavy material should always be cut, trimmed, and matched to the exact size before fixing. Lincrusta paper can be used to cover a ceiling, but the latter must be cleared of all flaky substance and well washed, then lined with stout white or brown lining paper. The relief paper may then be fixed with glue-paste.

Papering Ceiling.—Properly to paper a ceiling is an operation that requires an amount of deftness and skill that can only be acquired by experience. The paper is prepared in the same manner as for hanging on a wall. Special attention is, of course, paid to the method of pasting, and it is almost useless to attempt to put a common paper on a ceiling. The paper must be of good quality; and if it should be a heavy one, it may, as in the case of heavy wallpapers, be temporarily kept in place by drawing pins. In the case of a paper hung on a wall, the paper, until it is dry, is held in place partly as the result of friction, but principally by the adhesiveness of the paste; but when paper is hung on a ceiling, contact is maintained solely by the adhesiveness of the paste. It is necessary, therefore, to prepare the ceiling so that the paper may more readily adhere to it by first thoroughly cleaning the ceiling and then coating or sizing it with a solution of glue and whiting. When this is dry the paper may be hung. If the ceiling is at all rough, it should be smoothed with pumice-stone, as paper will not readily adhere to a rough surface. In hanging a relief paper on the ceiling of an irregularly shaped room, any old distemper that clings to the wall should be washed away, and a coat of size given when the wall is dry. Strike out lines on the ceiling as a guide to hanging the paper, and work strictly to the lines. The edges of the paper should be trimmed with a broad sharp knife guided by a steel-edged straightedge. The material should be soaked with paste, to which has been added a third part of Scotch glue. The joints must be butted, and after the paper is in position, the edges should be turned back and have a little extra paste applied on them, then replaced and rolled with a china wheel, but not so heavily as to damage the relief. The places where the joints come may be coloured, so that should the paper shrink, the joints will not be very noticeable. A stiff roll of paper on which to carry the pasted strip is handy when

hanging, and, should the strip be heavy, a few copper-headed tacks are useful to keep it in position till it dries. Care should be taken not to stretch the paper; and the rule should be to work from a central line, and away from the light.

Papering Damp Walls.—If the damp places are entirely due to a cause which has been removed, it would be as well to let the walls dry naturally before re-papering; but if damp places are to be rendered innocuous to paperhangings, an interposing waterproof medium must be provided. This may be either pitch paper—brown paper coated on one side with pitch—1-ply Willesden paper, or tinfoil. The latter is very satisfactory in use, as, owing to its extreme thinness, it can be applied in patches without the fact being noticeable through the covering paper. Tinfoil is hung with paste in the same manner as paper; and sometimes, in order to counterbalance any slight imperfection in the metal, the patch is given a coat of patent knotting (shellac dissolved in methylated spirit).

Papering Staircase having Dado.—The hall and landing should be marked out 3 ft. (assuming this to be the height of the dado) from the top of the skirting, and a line struck that height parallel with the skirting. The same height is taken from the skirting that is on the stairs, measured perpendicularly with the skirting, and not with the tread. When the line has been struck down the staircase walls, the filling should be hung, the lower edge being carefully cut level with the line. This is important, for if the filling is left uneven, the rough edge would look unsightly should the dado and border be varnished. If the filling is a plain one, it does not matter much from what angle a start is made, though it is easier to work from right to left. The paper must be butted; that is, the edges brought close together without overlapping. After the filling is put up, the dado should be hung, and then the border. The border should be mitered, instead of following the curve of the skirting, where it meets at an angle with the stairs and landing, stairs and hall, etc.

Papering Wall.—If the plaster is new it will require a thin coat of size. If it has previously been coloured with distemper this must be all washed off, and a coat of weak size given to the wall. When the paper is hung, its edges should be towards the window, so that the laps do not show. The edges should be cut close at one side, but not at the other by ¼ in. The paper must now be cut into lengths ½ in. longer than the sides of the room, so that the pattern matches. Care must be taken to cut straight across. Use the plumb-line to ensure the paper hanging straight. If it does not hang right, pull it away from the wall to within 6 in. from the top, then let it fall into its right place. With a soft clean cloth or clean brush begin at the top, going down the centre; gently press the paper down, then brush off from right to left. Be sure the edges are down. Mark with the blunt end of the scissors where the paper meets the skirting; cut, and dab it into its place.

Paste for Wallpapers.—Elastic or pliable paste may be made as follows:—8 oz. of ordinary starch, 3 oz. of white dextrine, 22 oz. of cold water, 2 oz. of borax, 6 oz. of glycerine, and 1 gal. of boiling water. Mix the starch and dextrine with the cold water to a batter. In another vessel dissolve the borax in the boiling water, then add to it the glycerine; then add gradually to the starch while constantly stirring, when it will turn into a translucent paste. This paste will not crack, but is very pliable, and may be used with advantage where flexibility is required, as on expensive paperhangings. Strong adhesive paste for heavy wallpapers may be prepared by mixing 8 lb. of rye flour into a batter free from lumps with 1 gal. of cold water; then add steadily 3 gal. of boiling water, constantly stirring; after which, ¼ lb. of powdered resin should be gently sprinkled in, a little at a time. Should the paste become thick when cold, thin to the required consistency with hot water. This is a good paste, and may be used for hanging heavy wallpapers or leather. The following are the ingredients for the well-known Venetian paste:—Fish glue 8 oz., cold water 16 oz., Venice turpentine 4 oz., rye flour 2 lb., boiling water 1 gal. Dissolve the glue in a glue pot with the cold water in a water bath or over a fire; then stir in the Venice

turpentine. In another vessel dissolve or make a batter of the rye flour with two pints of cold water, then add, while constantly stirring, the boiling water. The contents of the two vessels should now be stirred well together. This makes a paste that is very tenacious, and, owing to the Venice turpentine in its composition, will make paper adhere firmly to any painted surface. Lincrusta-Walton may be hung with a paste made by dissolving with boiling water 1 lb. of best Scotch glue, and adding to a paste made from 3 lb. of best flour; apply it very thick, and in a warm room.

Quantity of Paper Required.—The table below shows how to ascertain the number of pieces of paper that will be necessary for papering rooms of various sizes:—

Height from Skirting to Cornice.	*Measurement Round the Walls in Feet.*												
	32	36	44	48	56	60	68	72	80	84	88	96	100
Ft. Ft. 7 to 7½.	4	5	6	6	7	8	9	9	10	10	11	12	12
7½ to 8 .	4	5	6	6	8	8	9	10	11	11	12	13	13
8 to 8½.	5	5	6	7	8	8	9	10	11	12	12	13	14
8½ to 9 .	5	5	7	7	8	9	10	11	12	12	13	14	14
9 to 9½.	5	6	7	7	9	9	10	11	12	13	13	15	15
9½ to 10 .	5	6	7	8	9	10	11	12	13	14	14	15	16
10 to 10½.	5	6	8	9	10	10	12	12	14	14	15	16	17
10½ to 11 .	6	7	8	9	10	11	12	13	14	15	16	17	18
11½ to 12 .	6	7	8	9	10	11	13	13	15	16	16	18	18

Find the height of the room between the skirting and the cornice in the left-hand column of the table, and the nearest figure to the measure round the walls in the top line. The figures where the two lines cross or meet will show the number of pieces of paper required. In measuring round the walls the doors and windows are generally included; this allows a little for waste.

Re-papering. — Before re-papering old walls, all the old paper should be stripped off (by labourers or boys). It should be first saturated with water, and then scraped with a chisel knife, care being taken not to injure the plaster; the walls must next be thoroughly cleansed with hot water, and the surface stopped and repaired as for distempering. When the wall is dry, coat it with thin size.

Roll of Wallpaper.—A roll of wallpaper in America contains 8 yd., but ordinary papers are sold in double rolls, each containing 16 yd.; for this reason the term "roll" has an uncertain meaning. The standard of measurement is the "piece," not the "roll," the former being an 8-yd. length of paper, 18 in. wide as a rule. Thus an American roll is equal to one piece, and a double roll to two pieces. An English roll contains 12 yd., that is. 1½ pieces, and French rolls 9 yd., or 1⅛ pieces. Lately, however, French and German manufacturers have produced rolls to agree with English requirements. Japanese leather papers are in "Jap" rolls, each containing 12 yd. of paper, 36 in. wide, thus equalling in surface three American pieces.

Warming Bottle

A cheap and useful warming bottle can be prepared as follows:—Mix 1 part of sodium acetate with 9 parts of sodium hyposulphite, filling a stoneware bottle about three-quarters full; next, it is tightly closed with a cork and laid into hot water or placed in the oven, so as to cause the contents to melt. This bottle will give off heat for half a day or so, and becomes hot again when it is vigorously shaken from time to time.

Washing Copper

Cleaning Washing Copper.—To clean a copper in which hams have been boiled, thus rendering it unfit for boiling clothes, partly fill the boiler with water, add a little soda, and place in it a quantity of potato parings. Boil the water and well stir the parings to remove the grease. Now take out the water and parings and allow the boiler to cool; then apply a coat of whitewash made by slaking a little quicklime in water, and allow it to set.

Leaky Washing Copper.—There is no practical means of making an effective

repair to a cast-iron pan in which holes have been worn. Cement cannot be expected to remain sound, even though a zinc false bottom be put over it, but brimstone might be tried. Take a piece of stick brimstone, and melt and work some of it into the holes with a hot soldering bit.

Washing Liquor

Washing liquors consist of a solution of ammonia, or of a mixture of soap, ammonia, and turpentine. A suitable liquor can be made by dissolving ½ lb. of olive soft soap in 1 gal. of water, then adding 16 oz. each of turpentine and strong ammonia. The olive soft soap is a sweet kind of soft soap made from olive oil. It will be best to try the recipe on a small scale first, to see if it is suitable. Other recipes are: (1) A concentrated solution of sodium carbonate is rendered caustic by agitation with slaked lime. This liquid must be used very cautiously. (2) Mix together 8 parts of alcohol, 8 parts of oil of turpentine, and 1 part of liquor ammonia, and use three or four tablespoonsful to one pint of soft soap or one pound of hard soap. The fabric should be soaked in water for an hour or so before using this. (3) A mixture of 1 part of borax and 160 parts of water is suitable for fine laces, etc. For stiff fabrics, use 6 parts of borax. (4) Nottingham washing liquor is made by mixing together 42 parts of water, 8 parts of white soap, and 1 part of potassium carbonate. (5) Three parts of yellow soap, 8 parts of saturated solution of ammonia, and 256 parts of water, are said to constitute the Hall washing liquor. (6) Yorkshire wash is a mixture of 1 part of saturated ammonia solution and 16 parts of water. (7) According to a German recipe, 77 parts of dried soda and 23 parts of powdered quillaia bark make a useful washing powder.

Waste, Cleaning

For cleaning dirty, oily waste, a good method is to use a galvanised tub to which is connected a ½-in. steam pipe; the dirty waste is put into the tub, a box of Pearline added, and the steam turned on. When the waste has boiled for a few hours it is taken out and run through a clothes wringer, which puts it in a very good shape for use. Another method is to separate all the oil and a portion of the dirt in the waste and rags by means of a centrifugal washing machine.

Waste-pipe

Removing Obstruction from Waste-pipe. Take the case of a waste-pipe into which a stick or piece of cane has accidentally fallen. If it is found to be impossible to force the piece of cane through the pipe by means of a cane with a wad on the end, it will be necessary to cut a slit in the side of the pipe (assuming it to be lead) near where the piece of cane is lodged. The grease can then be removed by passing a flexible cane through, hot water being allowed to flow at the same time. The slit in the pipe should afterwards be closed and soldered over. A plumber should do this, as he has all the tools and appliances necessary. He would also be able to advise if a brass screw-cap soldered in the bend of the pipe, where the obstruction is most likely to occur, would be an advantage in view of future contingencies.

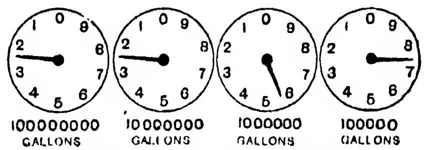


Fig. 607. Dials of Water Meter.

Water Meter

The dials of the simplest form of water meter are shown in Fig. 607. The four small dials are arranged in a row. The lowest dial (first on the right-hand side) reads up to 100,000 gal., and the highest dial (last on the left-hand side) reads to 100,000,000 gal. The simplest method of reading the meter is to note the position of the pointer on the lowest dial and write down the figure (the proper figure to read on each dial is the lowest of the two figures between which the pointer is found), and do the same with each of the other dials in order. When the figures have been written down, read off the total, which will be the

correct reading of the meter. In Fig. 607 the pointer on the 100,000 dial is between 8 and 7, consequently 7 is the correct figure, and represents 70,000 gal.; the pointer on the second dial lies between 5 and 6, therefore 5 is the correct figure, and represents 500,000 gal.; on the third dial the figure 2 represents 2,000,000 gal.; and on the fourth dial the figure 2 represents 20,000,000 gal.; these figures added together give a total of 22,570,000 gal. This method of reading can be used for all meters, either gas or water, that are provided with this form of dial.

Waterproofing

Waterproofing Fabrics.—Woven fabrics may be rendered waterproof in a variety of ways, one of the commonest methods being to apply a coating of rubber solution and then to vulcanise the film of rubber remaining after the evaporation of the solvent. By the waterproofing method of Hime and Node, zinc is added to a solution of cellulose in an ammoniacal copper solution; copper is precipitated, and the fabric to be proofed is immersed in the remaining colourless viscid solution of ammonium zincate and cellulose. The impregnated fabric is pressed, dried, and wet-calendered; that is, passed between rollers. By another method, a fabric having a close texture is treated with sulphuric acid (115° Tw.), the fibres being partly parchmentised thereby, and the interstices closed without the texture of the cloth being in any way injured. The excess of acid is washed out, with or without previous treatment with alkali, and the fabric is passed between calendering rolls, which complete the closing of the interstices. Holfert's process is to pass the fabric through a bath of gelatine and then expose it to the action of gaseous formaldehyde, the gelatine becoming insoluble. Another method of treatment is to apply to the fabrics boiled linseed oil, paints, varnishes, asphaltum, etc., as in the production of oilskin, tarpaulin, and the like. But one of the best of the waterproofing processes is explained below, in which the fabric is treated with an alumina soap. The word "soap" refers generally to a material used in removing dirt, and this it does by attacking grease and by removing the harshness or "hardness" of the water in use. But there are soaps which are insoluble or quite incompatible with water, and these have their use in rendering fabrics waterproof. The ordinary soap of commerce is in one of two classes—"hard" or "soft"—and is formed by boiling fats with alkalis. With soda as the alkali, a hard soap results; with potash a soft soap, these products being the alkaline salts of certain fatty acids—oleic, palmitic, stearic, etc.—derived from the fats used. When a solution of a salt of any other metal is added to a solution of either of the above soaps, a precipitate of an insoluble soap of that metal is formed, because all but the alkaline soaps are insoluble in water. In this manner it is possible to produce soaps of lead, copper, iron, aluminium, etc. Alumina soap, so largely used in waterproofing, is formed from alum and soap in the manner above described. In waterproofing fabrics with an alumina soap, one of two different methods may be employed. For the first method two solutions are required: (1) 1 lb. of alum in 1 gal. of boiling water; (2) 1 lb. of ordinary soap in 1 gal. of boiling water. Keep these solutions in separate tubs or troughs. The best soaps to use are palm-oil or white curd soap, but common yellow soap answers very well. The soap must be dissolved entirely or the coating will be patchy. When the solutions have cooled slightly, but while they are still warm, the cloth to be waterproofed should be immersed in the first for about fifteen minutes, so that the soap sinks into the fibre. The cloth previously should have been soaked in water and wrung out. After wringing out the excess of soap solution, immediately plunge the cloth into the alum bath, in which it may remain for an equal period, and, being removed, excess of alum solution may be wrung out also. If a thick coating of the alumina soap is required, the cloth may be put through this treatment two or three times, and, after steeping in clean water, it may be hung out to dry. The cloth on drying will be rather stiff and white, and somewhat rough, but will be quite waterproof; if the roughness is objected

to pass over the surface a hot iron, or calender the cloth between rollers. Any kind of cloth may be treated by this method, but the most suitable kinds are those that are closely woven, no matter how coarse the fibre is. Fabrics waterproofed in this way are but little altered; their feel is, however, somewhat harsh, and water poured over them will run off without wetting any part, the alumina soap having filled up all the interstices, and formed over the fibres a protective coat, which prevents the water touching the cloth. The second method of applying the alumina soap is in the form of a solution in petroleum ether. The alumina soap is formed by mixing together the boiling alum and soap solutions as previously prepared; for complete precipitation, 2½ lb. of soap will be required to every 1 lb. of alum. The alumina soap separates out as a large cake, which should be collected on a piece of cloth, and the water squeezed out. The cake may be broken up into small pieces, thoroughly dried at a low temperature, put into a dry, wide-mouthed bottle, and covered with petroleum spirit (benzoline); paraffin oil is unsuitable, because it forms an unmanageable, stringy mass. As the soap absorbs the benzoline it swells, and should be stirred from time to time, so that it is mixed thoroughly. The paste thus formed may be diluted as required with benzoline, but care should be taken not to add too much of it at any one time, because, on standing, the mass becomes unaccountably fluid, and possibly too thin; if this should occur, a little of the alumina soap is added. The waterproofing solution made in this manner may be laid on the cloth with a brush or, better, by passing the material through rollers fed with the solution. After treatment, the cloth should be hung out for a short time in the open air to allow the benzoline to evaporate. If a thicker dressing is required, the cloth may be coated two or three times; for ordinary purposes, however, once is quite enough. The alumina soap may be coloured reddish-brown by the addition of a little perchloride of iron in place of some of the alum, and green by the addition of sulphate of copper (blue vitriol). It is also possible to obtain other colours by employing solutions of other metals, but these are more or less expensive. The common colours, yellow and black, may be imparted by stirring in yellow ochre or lampblack with the soap solution in the first method, or by kneading it with the alumina soap in the second. Still another method of waterproofing fabrics is given below. This process has the recommendation that, whilst water is prevented from entering, the air is allowed to escape. Procure some best glue or concentrated size, make a weak solution of it (care must be taken that the solution is not too sticky), and, whilst still hot, add alum to it, stirring the mixture at the same time. This must be continued until the mixture has a decided taste of the alum, when what remains of the latter undissolved should be taken out. It is well to use a brass vessel for this purpose, as otherwise the mixture may become discoloured. The right proportion of alum may easily be ascertained by letting a few drops fall into a saucer and dipping the tip of the finger in it, applying it to the tongue. Have ready prepared a little soap in solution (soapsuds), which should be added to the mixture in the vessel. If the garment is of somewhat fine material, it is best to take this solution of size, alum, and soapsuds, and, while hot, brush the inside of the material with it until it has received an equal coating all over, taking care not to do any part of the outside, and to see that all the inside is fully covered. The nap of the cloth on the front side may be smoothed down, if necessary, by passing over it a clean brush dipped in cold water. Of course, coarse tweeds, moleskins, and other like materials which do not possess any definite markings, may be brushed over with the mixture both inside and out. The better plan, however, when the nature of the material will admit of it, is to dip the material bodily into the mixture. This will ensure the process being properly carried out. After the material has been thoroughly well impregnated, it should be passed through a wringer, the nap being smoothed down as before described. All

that now requires to be done is to expose the cloth or garment operated upon to the action of the air in order that it may dry.

Waterproofing Paper. — A transparent waterproof paper having the appearance of parchment may be prepared by immersing silk paper in an aqueous solution of gum-lac and borax. After drying in the open air, pass over it a hot iron.

Carnaüba Wax (*see* main heading, "Paraffin Wax").

Wax

Dentists' Modelling Wax.—This may be made by melting 16 oz. of yellow wax with 1 oz. of olive oil and then adding 8 oz. of wheat starch, 4 oz. of Venetian turpentine, and 1 oz. of Venetian red.

Grafting Wax.—A good grafting wax, as used by gardeners when grafting fruit-trees, consists of equal proportions of resin, beeswax, and tallow, melted in a metal pot over a slow fire, thoroughly incorporated, allowed to cool, and used lukewarm. But unless the wax is to be used in large quantities, it is much better to purchase it ready made. The French preparation, Lefort's Mastic, is a good one, and may be used either hot or cold.

Modelling Wax.—Generally it will be found much cheaper and more satisfactory to buy modelling wax than to make it, as first attempts generally result in a sticky mass, unpleasant to handle. However, here are some recipes: (1) 1 lb. of beeswax, 2 oz. of Burgundy pitch, and 1 oz. of lard, melted together over a slow fire, stirring well all the time; add yellow ochre in powder to give a colour. (2) 1 lb. of beeswax, ½ lb. of lard, and 1 gill of linseed oil, melted at a slow heat; add about 1 lb. of flour or sifted whiting, and knead well. If the mass is too sticky, add more flour or whiting. (3) 1 lb. of beeswax, ½ lb. of suet, and 1 gill of white turpentine; add whiting, as for (2). (4) Mix together equal quantities of beeswax and white wax, then for 1 lb. of the wax add 1 oz. of resin, ½ oz. of lard, and two or three drops of oil. Heat, and mix well. Any of the above mixtures may be tinted by the addition of powdered colours, as yellow ochre, Paris green, red-lead, vermilion, etc.

Paraffin Wax (*see* main heading, "Paraffin Wax").

Pliable Wax.—Beeswax melts at 150° F., so that placing in hot water will render it pliable. Either vaseline or lard will be suitable for keeping wax pliable and soft. The amount to be added will have to be proportioned to suit the particular purpose for which the wax is required, but, as a guide, melt down 4 parts of wax and add 1 part of either of the above materials; it will be easy to add more if it is required softer.

Refining Wax.—Shred the wax into a vessel of boiling water, and continue the boiling for some time; then allow the whole to get quite cold. The cake of wax may now be removed and the loose dirt scraped from the bottom.

Repairing Wax Dummies.—For repairing cracks in the face, etc., of wax dummies, a suitable composition may be made by melting 3 parts of white wax with, say, 1 part of clarified lard. More or less lard will make it softer or harder as desired. If it is wished to be of the same general tone as the figure, the necessary colour, in dry powder, may be added in melting; or the new work may be made to match afterwards with dry colour and a camel-hair brush. If the repair is in the mouth, eyebrows, etc., tube oil colour may be necessary. A few drops of balsam fir added to the wax will prevent it from melting in the sun. The tools for smoothing down should be of polished boxwood, or better, of bone; in form, they are like the human thumb, but on a smaller scale. Such modelling tools can be bought at the larger tool shops and of artists' colourmen. Failing anything better, a rounded tooth-brush handle will serve the purpose. Wetting the tool will prevent the wax sticking.

Saddlers' Black Wax.—Melt in a pan over a slow fire till thoroughly amalgamated ½ lb. of pitch and ½ lb. of resin, stirring slowly the while, then add about half a pennyworth of boiled linseed oil, and pour a small quantity of the mixture into a bucket of cold water. Allow to stand for half a minute, then pull the mixture hand over hand; if it sticks well together without cracking or breaking, it is right as to soft-

ness, but if it cracks and breaks, put in more oil; if too soft, add more resin or pitch. If the mixture is of the desired consistency, pour it all into the cold water, and pull it hand over hand till it floats on the water; cut a small piece and throw it in to try. Add more or less oil (or tallow will do), according to the weather.

Saddlers' White Wax.—Take equal quantities of wax (as used for best white wax candles) and white-lead and place in a vessel in an oven to melt; regulate the stiffness by using more or less wax.

Sealing Wax (*see* main heading, "Sealing Wax").

Shoemakers' Wax.—For use by shoemakers and saddlers, wax that chips or flies to pieces when in use is too hard; however, it may be tempered by the addition of a little tallow or oil, the whole being melted, poured into water, and thoroughly worked. The last operation is best accomplished by having a piece of timber at a convenient height, placing the wax across it, and giving both hands a simultaneous downward movement, gathering the wax together into a lump and repeating the process as quickly as possible until the material becomes too stiff to work. A good wax is made as follows:—To 5 lb. of best Swedish pitch add 1 oz. of beeswax and 1 oz. of olive oil; melt these together and work them as above, and if the wax is required black, add 2 oz. of lampblack. For white wax use 1 lb. of beeswax, ¼ lb. of clear pale resin, and ¼ lb. of best white-lead. Both kinds should be kept in water after being made into balls, to prevent these sticking together.

Squeezing Wax.—The following is a recipe for making squeezing wax for taking impressions from wood carvings:—Take ½ pt. of boiled linseed oil, ½ lb. of best beeswax, 2 oz. of Burgundy pitch, 2 lb. of best flour, and one pennyworth of dragon's blood. Cut the wax into thin slices, place it in an earthenware pot along with the boiled linseed oil and Burgundy pitch, and melt slowly. When the ingredients are thoroughly well blended, put the flour on a tin tray and pour in the mixture gradually, rubbing the flour thoroughly well into it. In the way of "squeezing wax" there is nothing better than the French modelling paste sold by Reeves. Another recipe is as follows:—Beeswax, 100 parts; Venice turpentine, 13 parts; lard, 6 parts; precipitated bole, 70 parts. Mix and knead the mass in water.

Wax Figures.—Wax figures are made of clarified beeswax. At ordinary temperatures it can be cut and shaped with facility; it melts to a clear fluid at a low heat, mixes with any colouring matter, and takes surface tints well; its texture and consistency can be modified by the addition of earthy matters, and oils and fats. When melted, it takes the finest impressions of a mould, and sets and hardens at such a temperature that no ordinary climatic influences affect the form it assumes. A coloured drawing is first made of the figure, or, if this be not possible, a photograph, with written description of the characteristics and features of the individual to be reproduced. A rough cast of the head is then made, and is carved into a resemblance of the portrait with modelling tools. Then it is tinted, the eyes inserted, the wig installed, and the figure dressed on a wirework dummy. The hands are usually cast in moulds.

Wax Figures, Cleaning.—(1) A method of cleaning wax faces or models is to rub them with a flannel slightly damped with turpentine. The colours, if faded, may be restored as described in a paragraph below. (2) To clean wax figures, make a solution of ½ lb. best white soap, with a little fuller's earth, to ½ gal. of hot water. When dissolved, let it cool; then apply with a sponge, and finish off with clear water. (3) Cut 1 lb. of white Castile soap into thin shavings and dissolve in 1 gal. of boiling water; allow to become cold before using. Sponge the heads with this solution and wipe off with a flannel wetted with clean water.

Wax Figures, Colouring.—Wax figures from which the colour has been removed by cleaning can be re-coloured in any of the following ways:—(1) The colouring of the heads may be done with transparent stains, as paints, being opaque, are liable to give a patchy appearance. The stains may be made by dissolving aniline dyes in methylated spirit; the solutions should

be weak ones. Eosine will be suitable for the whole of the face and a touch of a stronger solution for the cheeks. (2) Melt white wax with sufficient clarified lard to prevent the wax setting too quickly. The colours may be mixed with this as a medium, just as a painter would mix colours with oil; apply with sable- or camel-hair brushes. (3) Dry powdered colours may be rubbed upon the models with the finger, an artist's stump, a hare's foot, or a puff. Pearl white and rouge will probably be sufficient, especially if supplemented by a couple of tubes of oil colours for the eyebrows and lips. (4) The best plan is to remove the wax, place the deeper colours upon the papier-mâché, then cover the whole with slightly tinted wax and smooth as above. Finally colour the lips, eyebrows, etc., with oil colours.

Wax Fruit and Flowers.—The necessary things include 4 lb. of medium sand, a large pie-dish, a pudding-basin, a wooden spoon, and a small table-knife. For the mould obtain a 7-lb. bag of best fine plaster-of-Paris; for the model, 3 lb. or 4 lb. of best white wax. It will also be necessary to have a small quantity of each of the following dry colours:—Prussian blue, ultramarine blue, carmine, chrome-yellow, rose pink, purple, scarlet powder, No. 1 chrome-green, No. 2 chrome-green, and any other colours that taste may suggest. One bottle of balsam fir and some fine wire will also be needed. Begin by making a lemon. Take the basin and stand a lemon upright in it; surround the lemon evenly with sand till exactly half has been covered, so that one-half projects from an even layer of sand. Now encircle the visible half of the lemon by a band of paste-board 2 in. high, and exactly 1 in. larger in circumference than the fruit. In the pie-dish mix enough plaster-of-Paris to the thickness of a stiff cream to cover the half of the lemon with a coat ½ in. thick. Having got it to the right thickness, pour it over the half lemon, taking care that an even coat is deposited. The cardboard circle will prevent the plaster running away. Leave it alone until it is hard enough to handle; then take it up gently, take out the fruit without injuring the fine indentations of the peel in the interior of the shell, remove any sand that may be clinging to the base of the half mould, and make in the rim of it four holes, each large enough to hold a pea. Grease the rim and holes with a little oil and fat mixed; replace the lemon in the mould exactly as it was when removed, taking great care in that respect; fix a card rim round the outer edge of the half-mould, and the mould can then be completed. Wash from the utensils all traces of the previous plaster; this is most important. Mix fresh plaster, and pour it over the other half of the lemon, taking care that this is as thick as that previously mixed. The fruit is now completely coated with plaster. Let this dry as before; when it is ready, insert a knife between the join and prize it apart without damaging the interior; take out the fruit, and the mould is complete. Let the mould rest for half an hour. Casting the wax is the easiest part of the business. Melt in a covered basin enough wax nearly to fill one of the halves of the mould, and while it is warm well mix with it sufficient chrome-yellow. Now take the mould and immerse it in hot water for a minute; then add a little balsam fir to the wax, and pour it into one of the half-moulds. Fix the other half on, and, taking the mould in the hands, press the halves together, and shake the whole in such a way that the wax is run evenly over the interior of the mould. Do this for a few minutes; then plunge the hands with the mould into cold water, and leave it there for two minutes; take it out, open the mould, and the lemon will be complete, unless it is desired to touch up the ends with No. 2 chrome-green. In this way almost anything that is mouldable—including fruits, nuts, vegetables, etc.—may be made; and wax-working is not only instructive and pleasant, but, in the hands of a smart person, remunerative. For the making of wax flowers and leaves, get a sheet of glass 18 in. square. Put some soft soap in hot water in a bath, and stir it till it lathers. Warm some of the wax as for fruit, adding a little balsam fir; colour according to work in hand. When the soap-water in the bath is blood-warm, and the wax melted and coloured, steep

the glass in the water, take it out, plunge it into the warm wax, and when it has an even coat of wax on it, plunge it into the water again, so obtaining a smooth sheet of wax. Lay this on the board, dry it, and lay a natural leaf on it, making the veins on the wax with the thumb-nail. Cut out the shape of the leaf with a sharp penknife, and curl by bending over the finger or back of the hand. Join the leaves by the aid of fine wire, and mount under a glass case. Practice in making leaves will lead to the making of flowers, which are more difficult than fruit or leaves, as there are no moulds. Take a rose, for instance ; every leaf has to be made separately of very thin wax, and joined by wire. Keep on trying, however, as the same wax will do over and over again. The following short table serves as a guide to colouring. "Cast" means the colour the wax should be made while warm. "Applied" means put on dry after fruit is completed. Always get a fine specimen to copy :—

Fruit or Article	*Cast*	*Applied*
Apples	Chrome-yellow	Greenish touches
Banana Melon	Chrome-yellow	Greenish touches
Cherries	White or pale yellow	Touched up with lake
Egg Plums	Chrome-yellow	Touched up greenish
Filberts	Green	
Oranges	Different parts, yellow and red lead well mixed in the wax before casting	
Pears	Yellow	Touched up to nature
Plums	Prussian blue and red well mixed before casting	
Pineapple	Yellow	Experiment with gamboge
Pomegranate	Burnt umber	Touched up with purple
Peach	White	Touched up with chrome-yellow and lake
An Egg	White	Touched up with chalk

Cleanliness is indispensable ; not a particle of dirt must be near the work. In mixing the plaster, always remove all traces of one lot before preparing the next.

W.C. Basins, Cleaning

One pennyworth of spirit of salt will be found sufficient to clean any ordinary w.c. basin. Apply the acid by means of a piece of old rag tied to the end of a stick, and after sufficient time has elapsed for the incrustation to become softened, or partially dissolved, wash with clean water. If the incrustation is very thick, the operation can be hastened by scraping. Any spare acid should be thrown down the drains, as it is a dangerous poison.

Weights

Coins can be used as handy substitutes for weights. The table given below is only approximately correct. 5s. 6d. worth of new English silver weighs 1 oz. troy = 480 gr., and 1s. weighs $87\frac{3}{11}$ gr. One ounce avoirdupois weighs $437\frac{1}{2}$ gr. Therefore 5s. worth of silver at $87\frac{3}{11}$ gr. to the shilling weighs exactly $436\frac{4}{11}$ gr., or about 1·14 gr. less than 1 oz. avoirdupois. The error throughout the tables given is, therefore, at the rate of a little over 1 gr. per ounce, or $18\frac{1}{4}$ gr. error in the pound, and the difference is consequently only $\frac{1}{4}$ per cent.

From 1 lb. to ¼ oz., using numbers of coins of equal value—

Coins.	*1 lb.*	*¾ lb.*	*½ lb.*	*¼ lb.*	*2 oz.*	*1 oz.*	*¾ oz.*	*½ oz.*	*¼ oz.*
Half-crowns	32	24	16	8	4	2	—	1	—
Shillings ...	80	60	40	20	10	5	—	—	—
Sixpences ...	160	120	80	40	20	10	—	5	—
Threepenny-pieces ..	320	240	160	80	40	20	15	10	5
Pennies .	48	36	24	12	6	3	—		—
Halfpennies	80	60	40	20	10	5	—	—	—
Farthings ...	160	120	80	40	20	10	—	5	—

Ounce and parts, using combinations of coins of different values—

Weight.	*Half-crowns.*	*Florins.*	*Threepenny-pieces.*	*Shillings or Halfpennies.*	*Sixpences or Farthings.*
1 oz.	1	—	—	—	5
1 oz.	—	—	10	—	5
1 oz.	1	—	10	—	—
¾ oz.	—	1	1	1	1
¾ oz.	—	—	7	—	4
¾ oz.	—	—	5	—	5
¾ oz.	—	—	3	3	—
½ oz.	—	—	2	2	—
¼ oz.	—	—	1	1	—

Wheel-greases

The wheel-greases or lubricants tabulated below are suitable for all kinds of vehicles, and the simplicity of their manufacture and the small cost of the raw materials render them economical. The base used is principally resin oil, a product obtained by the distillation of resin.

	1	2	3
Crude resin oil	100	100	100
Heavy mineral oil	30	30	—
China clay	25	- -	—
Lime (slaked)	10	10	9
Soda solution 25° T. ...	10	—	10
Blacklead (plumbago) ...	-	- -	7
Cylinder oil	- -	—	26
Water	—	5	—

The method adopted in preparing these greases on a large scale is as follows:—First slake the lime and pass it through a sieve to remove flint and other gritty matter. The oils are then placed in an iron vessel and heated together. The china clay, lime, and lead are next added, and the whole is thoroughly stirred into a uniform mixture, when it is run into suitable packages and allowed to cool down for use. These greases are occasionally reduced or adulterated with French chalk, mica, whiting, and barytes, which should be well stirred in whilst the whole is fluid. The common varieties of grease may be made by simply mixing together newly slaked lime and resin oil, and the second recipe may be prepared without heat, the ingredients being merely mixed thoroughly.

White Acid (*see* Acid)

White-lead

White-lead is by far the most valuable pigment used by the painter, its excellent body and covering properties, and its great durability, rendering it a good priming for all kinds of work, especially on wood, of which it is a valuable preservative. It also forms the basis of most tints and shades, and in application it works far more easily than most other pigments, and covers much better. This pigment is distinguished from all others by the ease with which it mixes with oil, and by forming a paint which readily flows from the brush. Its great disadvantage, however, is its poisonous character, which affects not only those engaged in its manufacture, but also those who are much occupied in applying it. White-lead is a basic carbonate of lead, and is represented by the formula $2PbCO^3+PbH_2O_2$. It has far greater body and covering power than any other pigment, and consists of lead carbonate 68·95 per cent. and lead hydroxide 31·05. The carbonate is the material that imparts to white-lead its excellent body and colour, whilst the hydroxide in its composition causes the white-lead to combine chemically with the oil in a most perfect manner, thus giving the pigment its excellent covering properties. The most common process of manufacturing white-lead is known as the Dutch process; it was elaborated about four hundred years ago, and has been but slightly modified. In this method the white-lead is formed by the action of vinegar, or dilute acetic acid and carbonic acid, upon metallic lead. White-lead is offered for sale in two forms—as a dry powder, and as a stiff paste in oil. The latter form is principally used by the painter. To prepare it in this manner it is placed in a mixing mill driven by steam power, and 9 per cent. of refined linseed oil added, the product being afterwards passed between heavy granite rollers or levigating stones in order to ensure perfect fineness. Where high-class work is to be done, as in flatting panels, and in building up work for enamelling, the white-lead must be very fine, as on this quality the finish of the work depends. The simplest method of determining the fineness and density of white-lead is to place a small sample of the lead on a piece of glass with a little oil, and rub it on the glass until an almost transparent layer is formed, when any grit or any small particles of lead may easily be seen or felt on the palette knife. The density may also be checked by adding a small quantity of black to two samples of lead of equal weight; the deeper shade will indicate the lesser density. The adulteration of white-lead was practised to a considerable extent before the Merchandise

Marks Act was introduced, but now a special committee is empowered to analyse suspected samples of white-lead, and to take action against offenders adulterating or reducing it. The chief adulterant of white-lead is barytes, whilst small quantities of china clay and gypsum are sometimes used. The degree of purity may be ascertained by a variety of simple tests, the commonest of which is as follows: Take on a palette knife, scraper, or ladle, a small quantity of the suspected sample, and place it over the fire or over a gas jet. If the lead is pure, it will quickly turn into blue-lead, any residue representing the adulterant. White-lead endures well under exposure to sunlight, and to the influence of the normal atmosphere; but sulphuretted hydrogen rapidly discolours it, black sulphide of lead being formed. Acids and alkalis also act upon it. White-lead may be mixed with nearly all pigments, except those containing sulphur; for instance, ultramarine and cadmium yellow soon cause the resulting colours or tints to turn black. When white-lead is used on damp surfaces and kept from the light, it rapidly discolours, but is often restored on exposure to sunlight. A protective coat of varnish is useful in averting some of the disadvantages just mentioned. The pigment is not recommended as a primary coat for ironwork, as, unlike red-lead, it does not possess the elasticity required in order to allow for expansion and contraction of the metal surface it covers. It may, however, be used with advantage for the finishing coats on ironwork.

Whitening

Whitening Belts (*see* Belts).

Whitening Bone (*see* Bone).

Whitening Steps.—The stones used for whitening steps, etc., are frequently made from plaster-of-Paris; that is, old pieces of stucco. There are also several compositions which appear to be made up of pipeclay and other ingredients. Many stones are cut from ordinary sandstones.

Whiting

Whiting is prepared from the natural chalk, which occurs very extensively in the south of England and the north of France. The first operation after quarrying the material is to place it with water in the pan of an edge-runner mill, which is similar to a mortar mill, and to grind it until the material is thoroughly broken down into a soft slurry. It is further ground in a flat-stone mill, which consists of a large circular tank with a granite bed, a revolving spindle in the centre having two arms to which are attached two large blocks of granite with flat faces; these blocks are propelled around the tank as the spindle revolves, the whiting passing between the revolving stones and the granite bed being thoroughly ground. The whiting and water is run from the flat-stone mill into a series of tanks, flowing slowly from one to the other, and in its passage depositing the whiting, the coarsest particles settling in the first tank and the finer material in the last tank of the series. When the whiting has settled out the water on the surface is drained away, the sediment is dug out, placed on the floor of a drying room until somewhat hardened, then cut up into squares, which are further dried on iron plates in a heated room. The dry whiting is then ground to powder in an ordinary grinding mill.

Winchell's Cement (*see* Cement)

Windows

Cleaning Windows.—Clean windows on a dull day or when the sun is not shining on them, as otherwise they will be dry-streaked, however much they are rubbed (states the "Bazaar"). First, with a painter's dusting brush, dust them inside and out, and then wash all woodwork. In washing the glass avoid soap, using instead warm water containing a little ammonia. Use a cloth and pointed stick to clean out the corners, and then wipe dry with a cloth; not a linen one, however, as this leaves fibres on the glass. Polish with tissue paper or with old newspapers.

Cleaning Windows of Confectioner's Shop.—The best and easiest method of cleaning a confectioner's windows which are thickly coated with sugar is to use hydrochloric acid; the ordinary hydrochloric acid (spirit of salt) may be diluted with eight or nine times its volume of water and rubbed over

the windows with a rag, the whole being then washed off with water. The acid must not be put in a metal bucket, but should be kept in an earthenware pot, and care should be taken that it does not get into cuts on the hands.

Cleaning Windows that are Specially Dirty.—Take ½ oz. of quicklime and slake it in sufficient water to make a paste; then add 1 lb. of washing soda dissolved in 1 qt. of water; mix thoroughly, and wash the windows with this. Follow with clean water, and dry with a clean cloth. A little whiting, made to a paste with water, rubbed on, allowed to dry, and then rubbed off with a clean cloth, will also be of service.

Glass (*see* main heading, "Glass").

Glazing (*see* main heading, "Glazing").

Preventing Shop Windows Steaming.—The "steaming" of windows is due to the difference of temperature between the air contained in the window case and that of the street. Moisture on shop windows, when condensed and perhaps frozen, is a great trouble to tradesmen, whose only real remedy is good ventilation and possibly a row of gas jets at the bottom of the window inside. An application of glycerine has long been recommended, and a German paper has advised the application of a liquid consisting of 55 grammes of glycerine dissolved in 1 litre of 62 per cent. alcohol, containing, to improve the odour, some oil of amber. As soon as the mixture clarifies, it is rubbed over the inner surface of the glass. This treatment, it is claimed, not only prevents the formation of frost, but also stops sweating. Another German mixture, "Oculustro," is made by combining 97 parts of oleine-potash soap with about 3 per cent. of glycerine and a little oil of turpentine; only a small quantity of the composition is applied. The source of the above information does not state whether the plan is successful; on the whole, glycerine mixtures are failures, the only true remedy for the steaming of shop windows being thorough ventilation and a good heating system. Agents for removing moisture from windows or for preventing steam condensing upon them are placed by a correspondent of the "Scientific American" in the following order of merit:—Flame of an alcohol lamp, sulphuric acid, aqua ammoniæ, glycerine, aqua regia, hydrochloric acid, benzine, hydriodic acid, boric acid, alcohol, nitric acid, cobalt nitrate, infused tincture of nutgalls, and solution of ferrous sulphate. With the alcohol lamp flame, and using great care, the results were immediate and more lasting than with the other methods. The sulphuric and other acids were applied with cotton-cloth pads, care being taken not to allow dripping. The aqua ammoniæ gave instantaneous but only momentary effects.

Putting New Sash-cords to Windows.—When one of the sash-cords of a window has broken it is always advisable to examine the others, and if they appear to be of the same age, all four should be renewed; for though they may seem to be in fair condition, they will soon break. To re-cord a window, the two side beads must first be sprung off with a screwdriver, and the old unbroken cords cut, the top sash and the weights inside the casing being let down gently. The lower sash can then be lifted out, and when the beads have been removed, the upper sash also. Next the casing is opened and the cords detached from the weights; the pieces of old cord must be taken from the sash grooves by knocking out the nails. Four pieces of new cord should be cut, the same length as the old ones, which are generally of equal length. Joiners usually keep a bit of lead, about 1½ in. long, the thickness of the cord, tied to one end of a piece of strong thin string about 2 yd. long, this being called a mouse; the other end of the string is temporarily tied to the end of the sash-cord. The mouse is passed over the pulley and drops down the casing, so that the cord can be pulled down with it. To prevent the cord from being pulled right through, sometimes a knot is tied on the end; but this shortens it, making it rather awkward for tying on the weights at the other end. Another method is to stick a nail through the end, which damages the cord, and starts an early break. The best plan is to keep four pieces of wood, about 5 in. long (preferably ½-in. wood dowels), pointed sufficiently to allow of their being gently knocked in to wedge the end of the cord

against the pulley. All four cords can be put in, and as each weight is attached, it is drawn up to the pulley, and wedged to keep it there. Weights that are cast flattened at the ends should have the cord put through, and a knot tied at the extreme end, then tied over the end of the weight, so that it may hang plumb. Other weights are cast with a hole at the side which runs out at the top; in this case the cord should be passed in at the top, and two knots put on and hammered into the side hole. The free ends of the outside cords should then be nailed into the grooves of the top sash, using clout nails, and the wedges

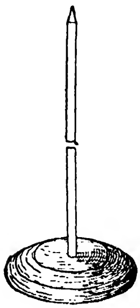


Fig. 608.

Fig. 609.

Fig. 608.—Wire-work File with Wooden Base.

Fig. 609.—Wire for Forming File.

pulled out; it will then go freely into its place, when the openings in the casing can be shut up and the beads put in. The lower sash is treated in the same way, the other beads being put in and nailed. Care should be taken that the cords are the right length, for if too short, the lower sash will not shut down properly, and the upper one will not open to its full extent. If the cords are too long, the sashes when pushed up to the top will drop, in proportion to the looseness of the cord. Pulleys that have got stuck should be made free and oiled so as to keep free, and new ones obtained to replace any that may be broken.

Window-polishing Paste.—Whiting simply mixed with water is usually employed for window polishing. Armenian bole is a kind of clay that is coloured red with oxide of iron, and white bole is a white clay. The recipe given below will produce a good window-polishing paste: Soap, cut into shavings, 1 part, dissolved in 10 parts of water; when this has set, mix with 2 parts of whiting. Armenian bole could be added if desired. Such pastes are best applied with a soft rag. Begin at the top of the panes and work towards the bottom, polishing off with a clean cloth or wash-leather, avoiding fibrous or hairy cloths.

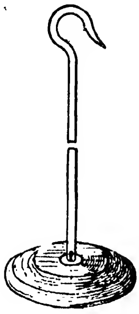
Wire Gauges

The following table shows the value in inches of the sizes of the principal wire gauges:

Number of Gauge.	*London or Old English.*	*English Legal Standard. (S. W. G.)*	*Stubbs or Birmingham. (B. W. G.)*	*Brown and Sharpe. (B. and S.)*	*Koebling.*
	Inches.	Inches.	Inches.	Inches.	Inches.
0000000		·5			-
000000		·461	--		·46
00000		·432			·43
0000	·454	·4	·454	·46	·393
000	·425	·372	·425	·40964	·362
00	·38	·348	·38	364	·331
0	·34	·324	·34	·32486	·307
1	·3	·3	·3	·2893	·283
2	·284	·276	·284	·25763	·263
3	·259	·252	·259	·22942	·244
4	·238	·232	·238	·20431	·225
5	·22	·212	·22	·18194	·207
6	·263	·192	·203	·16202	·192
7	·18	·176	·18	·14428	·177
8	·165	·16	·165	·12849	·162
9	·148	·144	·148	·11443	·148
10	·134	·128	·134	·10189	·135
11	·12	·116	·12	·09074	·12
12	·109	·104	·109	·08081	·105
13	·095	·092	·095	·07196	·092
14	·083	·08	·083	·06408	·08
15	·072	·072	·072	·05706	·072
16	·065	·064	·065	·05082	·063
17	·058	·056	·058	·04525	·054
18	·049	·048	·049	·0403	·047
19	·04	·04	·042	·03589	·041
20	·035	·036	·035	·03196	·035
21	·0315	·032	·032	·02846	·032
22	·0295	·028	·028	·02534	·028
23	·027	·024	·025	·02257	·025
24	·025	·022	·022	·0201	·023
25	·023	·02	·02	·0179	·02
26	·0205	·018	·018	01594	·018
27	·01875	·0164	·016	·01419	·017
28	·0165	·0148	·014	·01264	·016
29	·0155	·0136	·013	·01125	·015
30	·01375	·0124	·012	·01002	·014
31	·01225	·0116	·01	·00893	·0135
32	·01125	·0108	·009	·00795	·013
33	·01025	·01	·008	·00708	·011
34	·0095	·0092	·007	·0063	·01
35	·009	·0084	·005	·00561	·0095
36	·0075	·0076	·004	·005	·009

Wire Gauze

Cleaning Wire Gauze.—Gauze can be cleaned by well rinsing it with boiling



610.—Hanging Wire-work File.

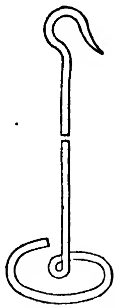


Fig. 611.—All-wire File.

water, and then gently scouring it with fine sand and a soft brush. Petroleum spirit would remove grease and dirt from wire gauze; it would, however, be better to supplement the dipping by brushing the gauze with a hard nail-brush. The spirit will evaporate off in contact with the air; no water need be applied. The grease and dirt can also be removed by gently heating the gauze over a burner, and, after cooling, shaking the dust out. The heat should be only sufficient to burn off any oil; a high temperature would oxidise the metal of which the gauze is composed.

Wire Work

Files.—The files illustrated by Figs. 608 to 613 are of the simplest form of wire work.

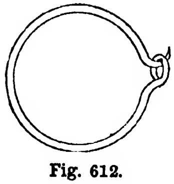


Fig. 612.

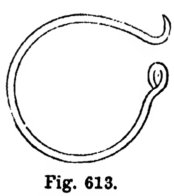


Fig. 613.

Figs. 612 and 613.—Ring Wire-work File.

Fig. 608 shows a small desk file from 6 in. to 8 in. high. Fig. 609 illustrates the method of sharpening the wire (No. 11 B.W.G.) and how the bottom portion is turned up to fasten into the small turned wood block. Cut off the necessary wire, point it with a coarse file, and finish with a fine one, so as

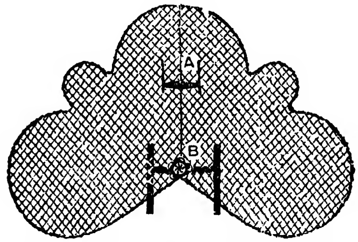


Fig. 614.—Fancy Design for Fireguard.

to get it as smooth as possible. With a pair of round pliers bend the end as shown at Fig. 609, bore a hole in the wood block, push the wire through, and tap it with a hammer, being careful not to split the wooden block by striking too heavily. Fig. 610 illustrates a similar file with the addition of a hook at the top, so that it can be hung up. Fig. 611 is an all-wire file. To make it, cut off a piece of wire 18 in. long, straighten it, sharpen the point and form a hook, then twist the ring at the bottom so that the wire lies across the centre of the ring, and bend the file so that it is vertical and in the centre. Figs. 612 and 613 show a very useful ring file that can be hung up, and yet when placed on the desk or table is out of the way.

Fireguards.—Figs. 614 and 615 show two designs for drawing-room or parlour fireguards, the first being a fancy design and

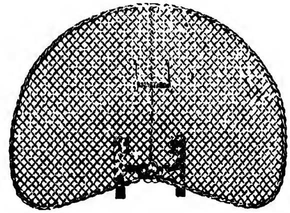


Fig. 615.—Circular Fireguard.

the second the ordinary circular fireguard. They can be constructed of ordinary iron wire, and painted any colour, or they may b

made of brass and afterwards dipped and lacquered. The mesh or crimped work is made out of wire equal to No. 18 or No. 19 B.W.G. The wire is first straightened by

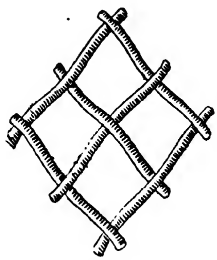


Fig. 616.—Corrugated Mesh in Wire Work.

drawing through a pegging block (a wooden block with pegs driven into it so that the wire is straightened by being drawn between them) and then passed through a crimping machine, forming small indentations or corrugations in the wire at about every ½ in. If one of these machines is not available, a wire worker will no doubt pass them through his rolls at a small cost. Having crimped the wires, they must be fitted together to form the mesh as shown in Fig. 616. Take a few of the wires, and lay them on the bench, interlacing them with each other (*see* Fig. 616). If required, the work can be bought ready made in rolls of any width and length from a wire worker. Having made the mesh, which should be about

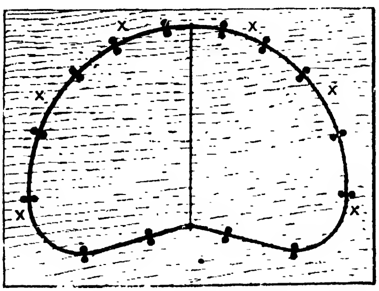


Fig. 617.—Board for Making Fireguard.

2 ft. 6 in. wide and 1 ft. 10 in. deep, the pattern should be drawn on a stout piece of board (*see* Fig. 617). Or the frame may be laid on the board and held by a staple or two, while some pegs or nails are fixed round the frame to hold it in position. The small dots round the frame in Fig. 617 represent the pegs. In patterns such as Fig. 615, which are simple, only a few pegs will be required, but in patterns of a more elaborate style, such as Fig. 617, it will be found necessary to have plenty of pegs to keep the frame from being pulled out of shape when the ends of the mesh are being turned over. The frame should fit tight between the pegs. Having made the rim to the pattern required, it should be fixed to the mesh work. The projecting ends of the mesh work are turned over the rim, and then cut off close to it. It will be found that the mesh, when being turned over the rim, will, if care is not taken, pull this out of shape. To obviate that, the mesh should be turned over at irregular intervals, say at X (Fig. 617). The turning over of

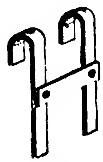


Fig. 618. Hanger for Fireguard.

two or three wires at these points will keep the frame in shape, but practice alone will show the best places to turn the mesh over. If necessary, a twisted edge of wire may be fixed round the edge of the guard (*see* Fig. 615), to make it more ornamental. This edge is made out of wires twisted together and fixed by tying with thin wire to the frame. A handle as at A (Fig. 614) must be made and fixed to lift the guard. The hanger B (Fig. 614) is made of pieces of flat iron (*see* Fig. 618), and is fixed in position either by riveting or tying. The small rosettes shown in Figs. 614 and 615 are simply for ornament, and may be any small stamping. The quantities given are for guards 2 ft. 2 in. by 1 ft. 6 in., the extra material in the mesh being to allow for turning over. The frames may be made of No. 10 B.W.G., or any other size to suit the maker, but the stronger the frame, the better and easier the job. If a cheap guard is required, small-

mesh galvanised netting can be used, a few more stays being fixed to the frame.

Garden Borders.—Figs. 619 to 621 show designs for some simple wire borders for the garden. They may be of any strength, length, and width, of ordinary common iron wire of any gauge. Suitable gauges are No. 14 B.W.G. for the bent parts, and No. 10 B.W.G. for the frames. When made, the borders may be painted, tinned, or galvanised. Fig. 622 shows the method of putting the frame together. It consists of five pieces of iron wire No. 10 B.W.G. The stays A and B are simply two straight pieces of wire 1 ft. 7 in. long, and the rails C, D, and E are three straight pieces of wire 3 ft. long, with loops or eyes at each end ready (*see* Fig. 623) for clipping to the upright wires. The panels F and G are placed one on the other as shown in Fig. 622. They should be tied to the frame, after clipping the loops to the bottom of the frame, with lacing wire No. 24 gauge. The best places to tie the panels on the frame are at H, J, K, and L. Fig. 624 is an enlarged view of the loop M through which the stays A and B are pushed to join the different lengths of the border together.

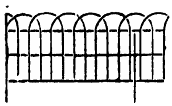


Fig. 619.

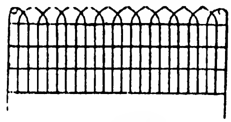


Fig. 620.

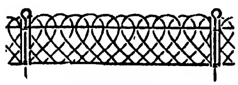


Fig. 621.

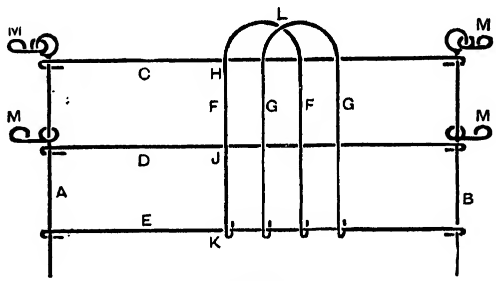


Fig. 622.

Fig. 624.

Fig. 623.

Figs. 619 to 621.—Wire Borders for Garden. Fig. 622.—Framing for Wire Border.
Fig. 623.—Rail of Wire Border. Fig. 624.—Loop for Connecting Frames of Wire Border.

Jointing Aluminium Wire (*see* Aluminium).

Paper Rack or Letter Rack.—A simple paper or letter rack such as is illustrated by Fig. 625 may be of any size, may have any number of hangers, and may be made of tinned, coppered, or brass wire; but, if of the last, it should be dipped and lacquered after being made. The dimensions given in Figs. 626 to 628 are for a newspaper rack, the wire required being 1 lb. of No. 11 B.W.G., or a stronger size if preferred. The tools needed include a pair of round-nosed pliers and a pair of cutting nippers. Cut off three pieces of wire, each 30 in. long, and turn an eye on each end, as at Fig. 629; then bend the wire to Fig. 626, and again bend on a wooden roller about 2 in. in diameter, so that the eyes stand well above the front portion, as in Fig. 627. Next cut off one piece of wire, 18 in. long, to form the hanger (Fig. 628), and use the same wooden roller for the loop in the centre, and bend the wire back to shape with pliers; then turn the eye at each end and bend the sides down. To put the rack together, simply hook the hangers on each other and close with pliers.

Wood

Artificial Wood.—In preparing artificial wood from sawdust, glue-water, water-glass, resin, blood, and glue with potassium bichromate are used as binding agents. The most reliable bin[illegible]ing agent is glue to which potassium [illegible]nate is added, to make the compo[illegible] waterproof, in-

soluble chrome-glue being formed when the substance is exposed to light. The glue solution is made up of 5 parts good pale glue and 1 part of isinglass. This mixture should be soaked, slowly heated in water, and carefully filtered. The quantity of water used should be such that the liquid is not transformed into a jelly-like mass when cool, but is just on the point of coagulating. The sawdust is worked into a mass with the glue solution. For moulding, moulds made of metal, plaster, or sulphur are employed; even wooden moulds may be used if they have been previously well varnished with a solution of shellac in spirit of wine. The plaster or sulphur moulds need oiling. The paste can first be applied in a thick coating and well moulded in by pressing with the fingers; then the space should be filled up with a mass prepared from coarser grains, and the surface covered and weighed down with a large plate. Before removing the mass, which is easily done when it is tolerably dry and has become compressed in consequence, any superfluous portions must be cut away with a broad and thin knife so as to level the lower surface of the relief. The articles can then be varnished or gilded; in fact, treated just like ornaments cut out of wood.

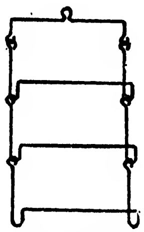


Fig. 625.

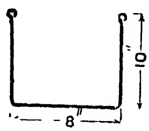


Fig. 626.

Fig. 627.

Fig. 628.

Fig. 629.

Fig. 625.—Wire Rack for Newspapers.

Figs. 626 to 629. Parts of Newspaper Rack.

Bending Wood.—Wood can be bent easily by soaking it in boiling water for from three to six hours, according to its dryness and thickness. It is then in condition for forcing into the required shape by straps and clamps. When got to position, it must be left so for t -four hours or longer, and then anoth .rty-eight hours must pass before any attempt is made to work it. Care should be taken to compress the inner curves rather than to stretch the outer ones. The first cut from the lower end of the tree gives the best kind of wood for bending; it should be straight-grained, young, and not too fully seasoned. A simple bend can be made with a rigid iron former, shaped like a link from a chain, or a thick plate of iron having a hole in it through which the piece of wood that has to be bent can be passed. The sides of the hole are bevelled off to soften the abruptness of a right angle, and the ends of the wood are then clamped down to the flat surface of the plate and kept there till the suppleness and elasticity imparted by boiling has disappeared and the wood retains its altered shape.

Staining Wood (*see* main headings, "Colouring" *and* "Staining Wood").

Wood Paste.—160 parts (by weight) of sawdust, preferably from soft varieties of wood, are well boiled in a solution of 100 parts (by weight) of aluminium sulphate in water and left to cool. Then 50 parts of glue are dissolved in 100 parts of water at boiling heat, and the solution thoroughly mixed with the sawdust pulp. The mass is then kneaded, rolled in pressing mats, and subjected to vigorous pressure. The pressed masses are very brittle at first, but acquire an extraordinary degree of hardness when allowed gradually to dry in the air. As soon as they are sufficiently hard, they are moistened from three to five times with a 5 per cent. solution of potash in water, and finally dried. Any kind of colouring matter or even crude coloured

sawdust can be introduced when mixing in order to obtain coloured wood paste.

Wool Grease

Wool grease, Yorkshire grease, or suint is obtained as a by-product in spinning mills from the wash-water of raw wool. The fine fatty coating constituting the fat of sheep's wool is known to preserve the skin of the animals in good condition and to render them capable of resisting climatic conditions. The human body also is provided with a substance serving a similar purpose. Many endeavours have been made to utilise these properties of wool fat in industry. Thus a medicinal pomade, the well-known lanoline, has been prepared for years from the purified and naturalised wool grease from which the fatty acids and soaps have been removed. Berthier succeeded in rendering clothes impervious by means of lanoline, he having noticed that the dress of the Arabs, woven from wool from which the fat has not been extracted, is almost impermeable. He immersed the fabrics in a wool-grease solution or sprayed them with it, then allowed them to dry. The garments thus prepared were found to be more permeable to air and exhalations than ordinary stuffs in a soaked condition. The goods became wet only on the surface, and absorbed but little water. Even repeated washing with soap does not remove the property. The process, being so simple, can be used by anybody, the neutral wool fat being employed. Berthier has succeeded in waterproofing shoe leather by this means.

Worms in Furniture

To get rid of wood worms which have infested some furniture, place the infested articles out of doors and well saturate with paraffin oil or coal-tar naphtha; should the oil leave any trace of greasiness, swill off with benzoline. A fine syringe to inject the solutions into the holes will be an improvement. A more drastic treatment is the injection of corrosive sublimate, 1 oz. to 1 pt. of water; but as this is a deadly poison it should be handled with caution. The operation should be repeated at intervals of a few days to entrap any stragglers that may be left behind. As the pests cannot subsist without air, fill up the holes already made by a mixture of 3 parts beeswax and 1 part resin, made hot and pressed well in with a chip; plaster-of-Paris may be used as a substitute. Both will require a little colour added to match the wood—Venetian red for mahogany, brown umber for walnut. A coat of spirit varnish afterwards will improve the appearance. Hydrogen peroxide is a sure remedy. (*See* "Violin, Remedying Worm-eaten.") So, also is fumigation in a closed chamber with pungent and noxious fumes.

Wringers (*see* Mangles)

Writing, Reviving Old

Some of the many methods of reviving old writing are the following:—(1) Brush over with a weak solution of sulphocyanide in water, and expose to hot hydrochloric acid fumes. (2) Wash over with very dilute hydrochloric acid, and apply an infusion of galls. (3) Suitable for written matter that has been immersed in sea water: Wash well with water and soak in a solution of 3 grains of gallic acid in 1 oz. of water. If this is not effective, soak in a solution of 10 grains of protosulphate of iron in 1 oz. of water.

X

Xylonite

XYLONITE is made from paper or cotton by treating with a mixture of sulphuric and nitric acids; it is a nitro-cellulose, and when mixed with various colouring matters, is fashioned into combs, etc. Celluloid is practically the same material as xylonite. The methods of treatment are the same.

Y

Yeast

Brewers' Yeast.—This is a by-product in brewing beer and in the preparation of whisky, and, except as an adjunct to these operations, it would not pay to make it. To prepare a small quantity, place $2\frac{1}{2}$ lb. of malt in a pan with 1 gal. of water and allow to steep for two or three hours, then raise the temperature of the liquid to 170° F. After about half an hour's heating strain the liquid through a fine sieve into a bowl of water. Allow the liquid to cool to 70° F., take a teacupful of brewers' yeast or about $\frac{1}{2}$ oz. of dry yeast, mix it with about a quart of the cooled liquid, and pour the mixture into the remainder of the liquid in the bowl. Stir well, then cover the bowl with a cloth and allow to ferment for from thirty-six to forty-eight hours. Now skim off the yeast, place it in a fine hard sieve, and wash once or twice with water; this will be in the condition of brewers' yeast. The dry yeast is a distillery yeast dried by centrifugal means or by pressure. Brewers' yeast is not satisfactory when pressed, as it does not keep well. In the fermentation of beer or other liquid the yeast cells produce carbonic acid in large quantity, and this gas carries the yeast to the surface of the fluid. The evolution of carbonic acid goes on for some time after removal from the fermented liquid, and some of the gas remains in the cells; so that even if placed in water the yeast will rise to the surface, but after a time, when all the gas has passed away, the yeast will sink to the bottom. If, however, sugar or any fermentable material were added to the water, the action would recommence and the yeast would rise again.

German or Dried Yeast.—This originally came from Germany, but at the present time the little that is imported comes from Holland. The greater part is now made in the United Kingdom, hence the name is not now properly German yeast, but dried yeast. It is a product of the manufacture of whisky, and it would not pay to make it anywhere but at a distillery. It is produced by making a mash of barley similar to that for beer, and fermenting it by the addition of yeast; during the fermentation, the yeast, which is a low form of plant, grows at an enormous rate, and comes to occupy a much greater bulk and weight than when it was originally put in. A portion is taken off to add to the next mash; the remainder is washed and pressed, leaving a stiff, pasty mass which is cut up and sewn in bags.

Quickly-prepared Yeast.—The following are recipes for handy stop-gap yeast: (1) Boil $\frac{1}{4}$ lb. of flour and 2 oz. of sugar in 2 qt. of water; let it cool to blood-heat, then add a gill of brewers' yeast or 2 oz. of dried yeast. Put it into a vessel to ferment for two days, bottle, and store in a cool place. Keep 1 pt. of this for the next brewing in place of yeast. (2) 1 oz. of hops in 2 qt. of water; boil for a few minutes. Mix in a pan $\frac{1}{2}$ lb. of flour, 1 oz. of sugar, and 1 oz. of salt. Pour the boiling extract through a strainer on to the mixture, and stir up. When at about 80° F., pour into it about $\frac{1}{2}$ pt. of brewers' yeast or 2 oz. of dried yeast. Work it for two days, put it into a jar, and tie down for keeping.

Z

Zinc

THIS is a bluish-white and highly crystalline metal, very malleable when pure. Impure commercial zinc is inclined to be brittle. Cast zinc is named spelter, only the rolled metal being known as zinc. It oxidises at a red heat, but the rolled metal forms a film of grey sub-oxide at an ordinary temperature if in a damp situation. Zinc is hardened by rolling, and is annealed at a low heat to make it malleable. The pure metal is dissolved by nitric acid and alkalis, but not by hydrochloric or sulphuric acid, though commercial zinc is readily dissolved by either of these. It is much used as a pure metal, and also in alloys. "Galvanised iron" is zinc-coated sheet steel. Zinc is very volatile, and thus has to be extracted from its ores by distillation.

Blackening Zinc.—For blackening zinc two or three good processes exist. One is to dissolve copper in nitric acid, taking care to saturate the acid completely. The solution, diluted with water, blackens clean zinc instantly. A better black is got by dissolving chloride of antimony in hydrochloric acid and diluting with spirit. Only just enough acid to dissolve the antimony chloride must be used; dilute it with twenty times the volume of spirit. The solution is applied to the zinc, which must be clean and dry. The metal then becomes of a velvety black. The blackened zinc must not be touched till it has dried perfectly, and this will sometimes take as long as twenty-four hours. After that, however, the coating will stand ordinary cleaning. The black may be made lustrous by rubbing it with linseed-oil, and will stand exposure to the weather perfectly well. The following method is recommended for chemically blackening zinc. Thoroughly scour the metal with sand, and dip in a solution composed of chloride of copper 90 gr., zinc nitrate 60 gr., hydrochloric acid ½ oz., water 4 oz., and then heat slowly. A non-chemical method . . use a varnish composed of sandarach, 100 gr., alcohol 2 oz., and nigrosin 5 gr.

Cleaning and Polishing Zinc.—The only way of improving the appearance of dull zinc is to clean it thoroughly. One method of doing this is to moisten some fine sand with raw spirit (hydrochloric acid), and quickly scour the metal with this mixture, then wash off the sand and acid with clean water, dry the metal with an ordinary chamois leather, and polish with whiting. A more brilliant polish can be obtained if the oxidised film is removed from the surface of the zinc by scouring with oil and fine emery powder, the oily surface dusted over with whiting, and then cleaned off with a soft duster until the metal is quite bright.

Zinc White

Zinc white or Chinese white is oxide of zinc, the exact composition being zinc 80·25 per cent., oxygen 19·75 per cent. The methods of preparing zinc white are many. The principal one is to sublime metallic zinc in fireclay retorts and allow the vapour to burn in air, the resultant fumes subsequently being condensed. Zinc white is used in painting with the object of avoiding that blackening of the work which in certain circumstances occurs when paint containing white-lead is used. As the ordinary boiled oil and varnishes contain lead, some purer medium must be used for mixing with zinc white, or the desired effect will not be attained. The zinc white should be ground to a stiff paste with a pale manganese drying oil, and then diluted with a mixture of equal parts of the same oil and turpentine for the first two coats, the medium for the last coat being principally turpentine, so that the surface will not be brilliant. Should a tint be required in order to produce ivory white (though this is not always the case), a very minute quantity of yellow ochre and Venetian red may be added. The tints should first be tried experimentally on a piece of wood.